

AAI AUTOMOTIVE INDUSTRIES

**AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT**

APRIL 1, 1957

In This Issue

**Extensive Conveyor Systems at Thompson Products Co.
SAE Natl. Passenger Car, Body and Materials Meeting
Ford's Experimental Tractor Has Free Piston Engine
Local Load Effects Overcome in Sandwich Structures
New Semi-Automatic Truck Transmission Introduced
Versatile Air Tools for Production of Aircraft**

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A CHILTON PUBLICATION

A new line of Standard Oil greases

RYKON

GREASE

Major breakthrough in grease technology results in development of new thickening agent. New grease has greater high temperature stability, superior multi-purpose qualities, improved lubricating properties.

Standard Oil instituted a grease research and development project several years ago. The result of this work is the line of RYKON Greases, which contain a unique new non-soap, organic thickening agent.

RYKON Greases surpass in stability and performance the best greases made up to this time. They bring to industry new opportunities for improved machine performance. They greatly reduce the maintenance and grease handling problems encountered in industry.

RYKON Grease properties

RYKON Greases are smooth, buttery-textured greases, made from the finest quality, solvent-extracted oil. Their thickening agent is a Standard Oil exclusive. RYKON Greases have these high-quality characteristics:

High temperature stability—Better heat stability than any other petroleum oil grease. ASTM dropping point of 480°F. Maintain consistency in service at high temperatures.

Mechanically stable—Maintain consistency even under severe mechanical working in service.

Chemically stable—Inhibit oxidation. Oil and thickening agent in combination possess extremely good chemical stability.

Wide temperature range—Lubricate at high and low temperatures. Extended range of application thus obtained makes RYKON Greases truly multi-purpose.

Water resistance—Do not lose consistency in presence of water. Highly resistant to water washout.

Oil separation—Minimum bleeding of oil in service and storage.

Anti-rusting—Exceptional natural rust preventive characteristics.

With RYKON Greases, lubrication can become simple, foolproof and less expensive—much less expensive, perhaps, than a single shut down caused by equipment failure due to the use of the wrong type of grease or the use of an "economy" grease lubricant.

RYKON Greases come in four Regular and three Heavy-Duty grades. Thus there is a RYKON Grease to take care of every grease lubrication job. Using RYKON Greases plant-wide can reduce your grease storage requirements, simplify lubrication maintenance training, cut down record keeping, save on dispensing equipment and reduce investment in grease inventories.

Get more facts about RYKON Greases. Call your nearby Standard Oil industrial lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Check Chart Of RYKON Greases

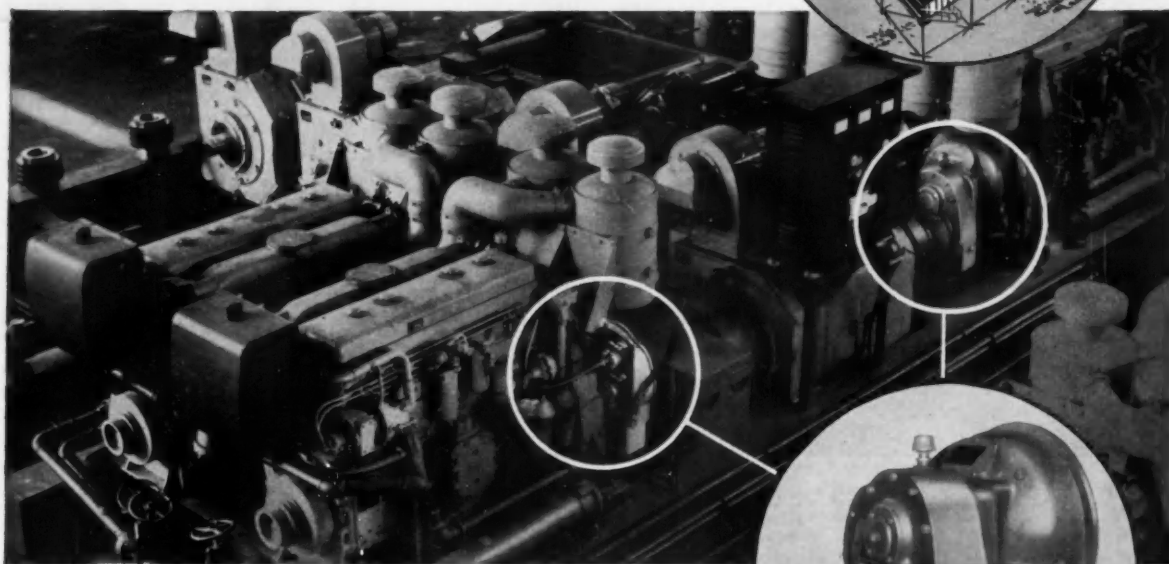
Regular Line	Grade Consistency
RYKON Grease No. 0	0
RYKON Grease No. 1	1
RYKON Grease No. 2	2
RYKON Grease No. 3	3
Heavy Duty Line	
RYKON Grease No. 0 E. P.	0
RYKON Grease No. 1 E. P.	1
RYKON Grease No. 2 E. P.	2



STANDARD OIL COMPANY (Indiana)

5000 hp round the clock

**COMPACT PACKAGES SHARE THE POWER LOAD,
KEEP OFF-SHORE RIG RUNNING**



COTTA HEAVY-DUTY REDUCTION UNITS **Reduce engine shaft rpm**

Continuous power for diesel-electric off-shore drilling rigs is furnished by a new method of heavy-duty power generation . . . compact power packages. Each package consists of two 600 hp generators and four 250 hp diesel engines. Five power packages capable of a combined output of 5000 hp are used in the rig. Cotta Heavy-Duty Reduction Units are used to harness engines to the lower rpm generators.

All four or any combination of the four engines in each power package can drive either or both

of the generators. This assures constant power even if one engine is cut out. The need for continuous, dependable operation under severe conditions is a major reason why Cotta Reduction Units are used in these Stewart & Stevenson RIGELECTRIC generator packages. Long-run, dependable service with minimum maintenance has made Cotta the choice for a variety of heavy-duty speed conversion jobs. If you need a standard or special reduction unit in the input torque range of 150 to 2000 ft lb, get the full Cotta story.

THIS INFORMATION WILL HELP YOU

Sent free on request — diagrams, capacity tables, dimensions, and complete specifications. State your problem — COTTA engineers will help you select the right unit for best performance. Write today.

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS



COTTA

**HEAVY-DUTY
REDUCTION UNITS**

"Engineered-to-order"



Newest Dart 55-ton...

Nickel alloy steels lighten ore carrier axles, absorb terrific loads and impacts

**"In 22 years," Dart metallurgists say,
"we've found no stronger, tougher axle steels"**

This is a real bear cat . . . 55 tons, 25 cubic yards, 400 horsepower.

It's the latest of a long line of heavy-duty, high-capacity Dart trucks.

Like their first model built 22 years ago, it is designed for maximum load capacity and minimum tare weight. And like their first (many of which are still in service) its axle shafts are forged of 4340 nickel-chromium-molybdenum steel. They are heat-treated to a hardness of 400/440 Brinell, equivalent to tensile strengths ranging above 200,000 p.s.i.

The housings are alloy steel castings, of approximately Type 4335

composition, heat-treated to provide a minimum tensile strength of 100,000 and yield strength of 85,000 p.s.i.

Dart has never found another steel to equal the 4300 type for heavy-duty axles . . . and they've tried many. Here's what it gives them:

1. Dependable high strength that allows safe designing for low weight.
2. Toughness to resist bone-shaking impact under heavy loads and low operating temperatures.
3. Good machinability at high hardness.
4. Excellent hardenability.
5. Ready weldability along with high strength in cast housings.



Light, strong, easy-to-fabricate. This is the axle assembly for the Dart ore carrier. Housing contains a triple reduction power transmission; wheels, a double reduction carrier and single reduction planetary. To increase the strength/weight ratio and obtain top-notch casting and machining properties, Dart Truck Company, Kansas City, Mo. makes both shaft and housing of medium carbon nickel-chromium-molybdenum steels.

★ ★ ★

Nickel alloy steels are used for dependable trouble-free performance in the most demanding applications. Do you have such a problem in your equipment? Send us the details, we may be able to help you . . . write today.



THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street
New York 5, N.Y.

AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE

PUBLISHED SEMI-MONTHLY

APRIL 1, 1957

VOL. 116, NO. 7

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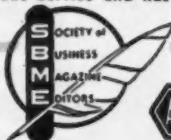
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As part of its worldwide automotive and aviation news coverage, AUTOMOTIVE INDUSTRIES is serviced by International News Service and has editorial correspondents in major United States and foreign industrial centers.

MEMBER



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NEW ROTOR

"117"
series

Small-Wheel Air Grinders

Check these features:

Governed for top production. Runs at best practical working speed for *maximum power*. Available in 17,000, 12,000 or 8,000 rpm.

Quiet. Designed for quiet operation.

Wide selection. You can select from over 150 different combinations of speeds, spindles and throttles to do *your job*.

Ask the Rotor Application Engineer for a demonstration on your job. Bulletin 59 free on request. The ROTOR TOOL Company, Cleveland 32, Ohio.

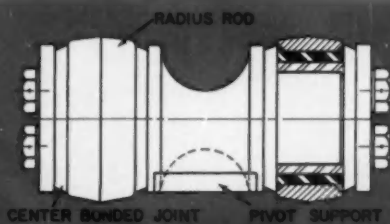
Here's the RIGHT
TOOL for YOUR job!



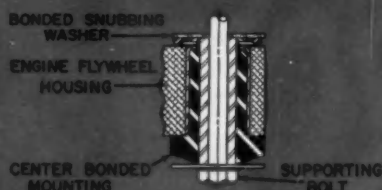
Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR
TOOLS
CLEVELAND, OHIO

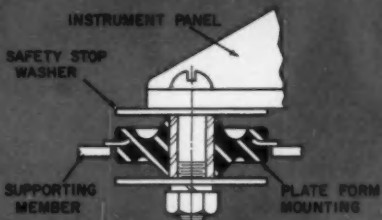
LORD bonded rubber mountings improve automotive performance



CENTER BONDED JOINT—**OFF-THE-ROAD-TRUCKS**—Terrific shocks and jolts of off-the-road equipment are accommodated by Lord lubrication-free Dynaflex® joints installed at the torque rod ends of the suspension system.

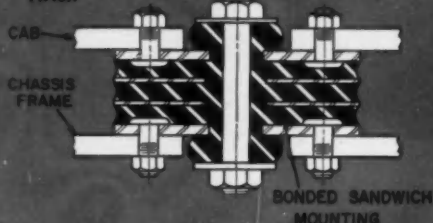


ENGINES—Lord center bonded mountings isolate powerplant noise, accommodate misalignment and provide more effective shock and vibration control.

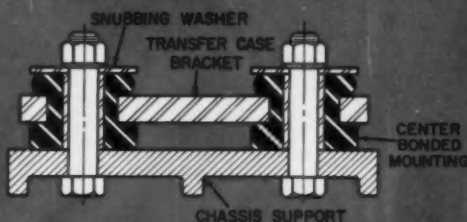


INSTRUMENT PANEL—Supporting control panel on soft, resilient rubber mountings prevents damage from engine vibration or operational shock and extends service life of the instruments.

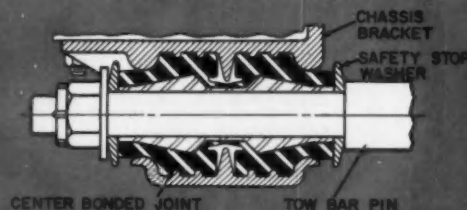
TRUCK CABS—Lord bonded sandwich mountings combine high strength with resiliency to provide smooth, quiet riding in truck cab by absorbing road noise and truck motion and protecting cab from chassis twist.



TRUCK TRANSFER CASE—Lord center bonded mountings eliminate noise transfer, absorb road shock and accommodate chassis twist.



TRAILER HITCH JOINTS—Lord center bonded joints absorb road shock to provide a more secure trailer hitch and greater driver comfort.



These are only a few of the many successful automotive applications designed by Lord. Each vibration control system is engineered to meet the specific installation requirements.

Find out how Lord bonded rubber mountings and joints can

reduce noise, frictional wear, metal-to-metal contact, maintenance and lubrication. Lord Field engineers are located in major industrial centers. Call or write the Lord office nearest you.

ATLANTA, GEORGIA - Cedar 7-1123
BOSTON, MASS. - Hancock 6-9135
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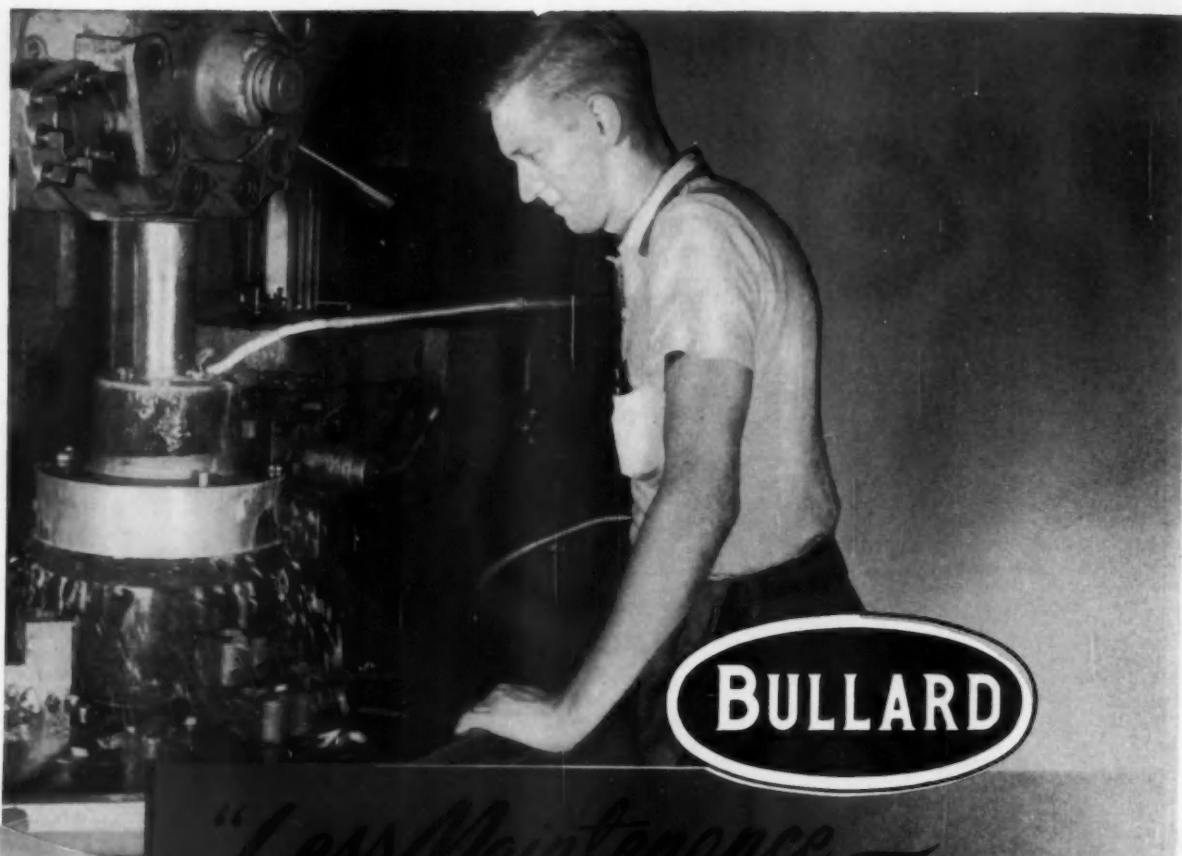
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LORD MANUFACTURING COMPANY • ERIE, PA.



designers
and producers
of bonded
rubber
products
since 1924



BULLARD

*"Less Maintenance—
Less Down Time*
Increased our Production"

This statement by Methods Supervisor Raymond Hoss of the Ingersoll Milling Machine Company of Rockford, Illinois summarizes one of the benefits they received from the purchase of a 36" Cut Master V.T.L., Model 75. Less operator fatigue, higher speeds, power chucking and power indexing turret are other factors which increase the overall production obtained with Bullard Cut Master, Model 75.

*These same benefits can be applied to your production problems—
just call your nearest Bullard Sales Engineer—he'll be glad to help—or write*

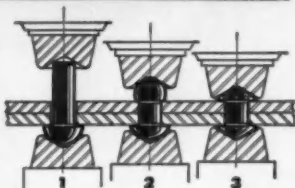
THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT



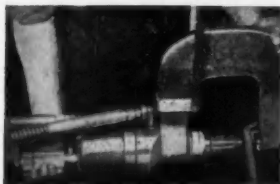
**WHY
HANNIFIN
"HY-POWER"
RIVETERS
SAVE YOU
MONEY**

STRONGER JOINTS!

This "silent squeeze" method gives you (1) rapid advance to riveting position, (2) high-pressure shaping of the rivet, cold or hot, and (3) automatic reversal as soon as the rivet is formed. Why are these rivets stronger? Because with this method the rivet shank expands to completely fill the hole and, as the metal flows to shape the heads, fillets are formed under both heads. The rivet is work-hardened, too, and every rivet is uniform.



FASTER RIVETING!



Yes! From the time the button is touched it takes only $2\frac{1}{2}$ seconds to head a $\frac{3}{8}$ " rivet. "Hy-Power" is safe, too! For the stroke can be interrupted and the ram reversed automatically anywhere in the cycle, simply by releasing the control button.

QUIETER OPERATION!

Here's the power source for this modern riveting method . . . it's the Hannifin "Hy-Power" Generator. This compact unit is a combination of motor, pump, oil reservoir, automatic control valves and high pressure intensifier that quietly supplies hydraulic pressure to...



...your "Hy-Power" cylinders—available in $7\frac{1}{2}$, 10, $12\frac{1}{2}$, $17\frac{1}{2}$, 25, 35, 50, 75 and 100-ton capacities (more in multiple). Cylinders can either be mounted in yokes (portable or stationary) or installed in machines of your design.

GET THE FACTS!

Get Bulletin 150. Learn why cost-conscious firms in many fields use "Hy-Power." Just write for your copy of this 32-page book. We'll mail it promptly.

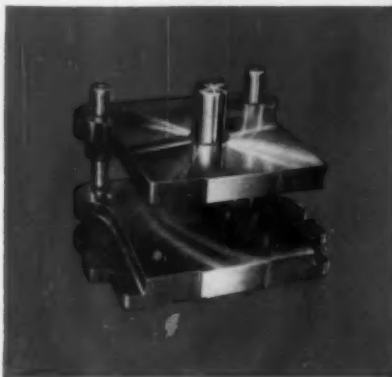
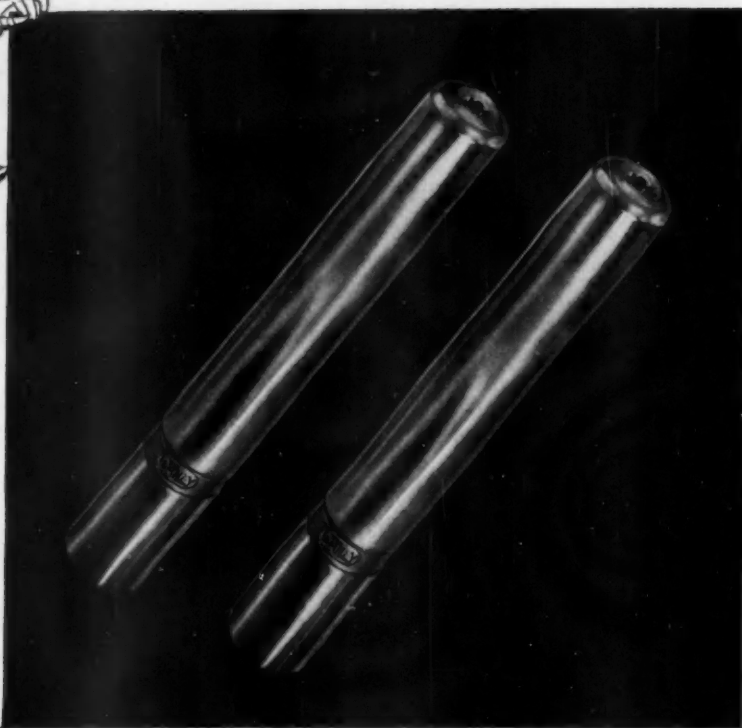


HANNIFIN

Hannifin Corporation, 543 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

NEW "Microme" chrome plated guide posts



ON **NEW** DANLY DIE SETS

Now standard on all Danly precision die sets, MICROME chrome plated guide posts typify Danly leadership in die set design. Years in development, they represent only a part of Danly's never-ending effort to provide the finest in quality. These new posts are extremely hard and have very high resistance to wear. Super smooth finish helps to guarantee lasting precision performance . . . they are another important reason why you should specify Danly die sets.

Leading industrial distributors and Danly branch assembly plants—located in all major tooling centers—stock Danly Die Sets for fast delivery.

DANLY

**DANLY MACHINE
SPECIALTIES, INC.**
2100 South Laramie Avenue
Chicago 50, Illinois



"Here's where Stainless makes the difference"

"Does the increased use of Stainless Steel mean anything to you?" we asked the head of the Used Car Department of an Ohio agency. "It makes a big difference," he said and proceeded to point out that a trade-in with stainless trim and accessories almost always commanded a higher price than one without. "The reason is readily visible right here," he said and pointed to the grill of a car sitting in the lot. "Notice how we were able to bring the stainless parts back as good as new. Now, notice the trim section, not stainless, that is pitted and discolored. Nothing we could do, and it detracts from the value of the car. In my opinion, the increased use of Stainless is the greatest

thing that could happen to the used car business."

Leading automotive designers recognize this fact—that's why every year more parts are fabricated of Stainless Steel—much of it from the mills of Sharon—where buyers know they can expect consistent quality plus the industry's finest finish.

SHARONSTEEL

SHARON STEEL CORPORATION

SHARON, PENNSYLVANIA

DISTRICT SALES OFFICES: CHICAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, SEATTLE, MONTREAL, QUE., TORONTO, ONT.

Does A Big Job

Takes Less Space

TYPE Z RELAY by Westinghouse

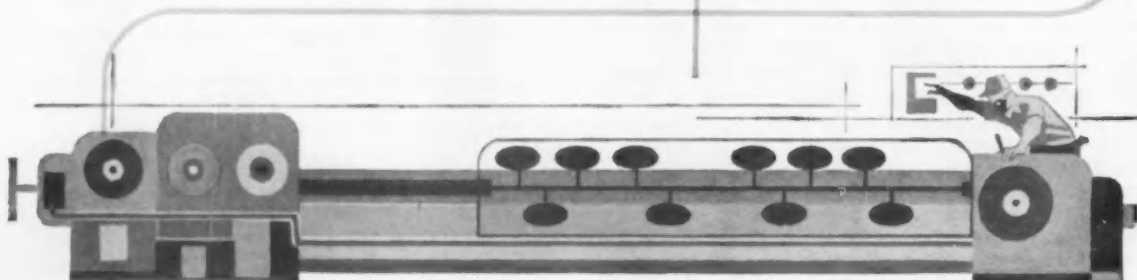
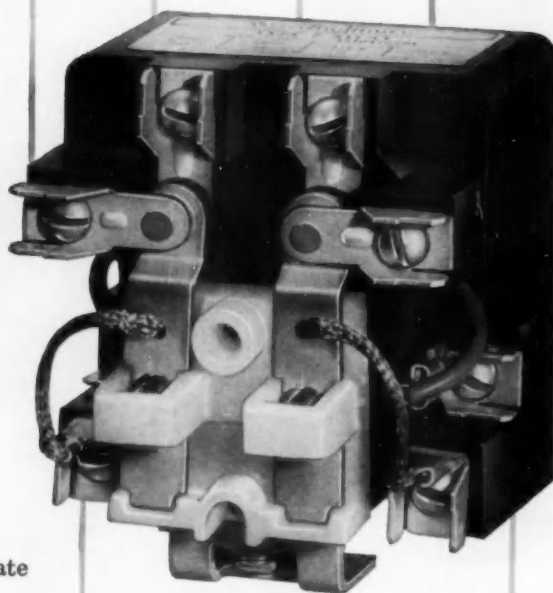
Small, versatile, amazingly rugged, this new Westinghouse relay is designed for long life and high reliability. The relay user who has space problems . . . wants a lot of relay in minimum mounting space finds Type Z ideally suited. Type Z meets U. L. Standards for 230 volts, is equipped with double-pole double-throw contacts of fine silver. Coil and core are interchangeable for a-c or d-c operation. An ideal relay for auxiliary multiple-circuit switching of light loads, small motors or for operating larger contactors or starters.

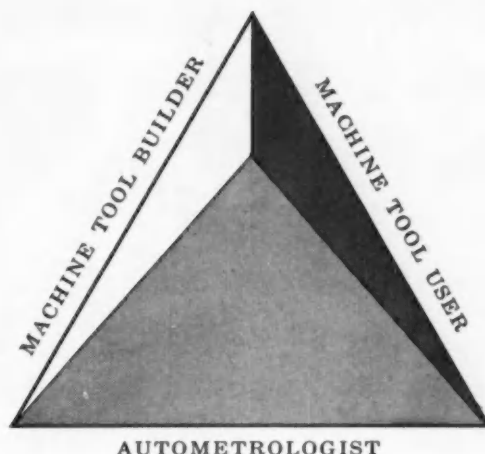
J-30262

**YOU CAN BE SURE...IF IT'S
Westinghouse**



Nylon armature insulating plate
Encapsulated removable coils
Firm contact pressure, low resistance





THE AUTOMATION PYRAMID

The very essence of automatic metalworking and part transfer is CONTROL. And, for greatest effectiveness, control must be an integral part of the basic design of the system—not a belated afterthought.

Thus, the Automation Pyramid rises from a base that incorporates the concurrent efforts of the user, the machine tool builder and the “autometrologist”*. Each contributes essential knowledge and experience that is exclusively his.

The user alone can define the task by specifying the design, quality and production rate of the product to be made.

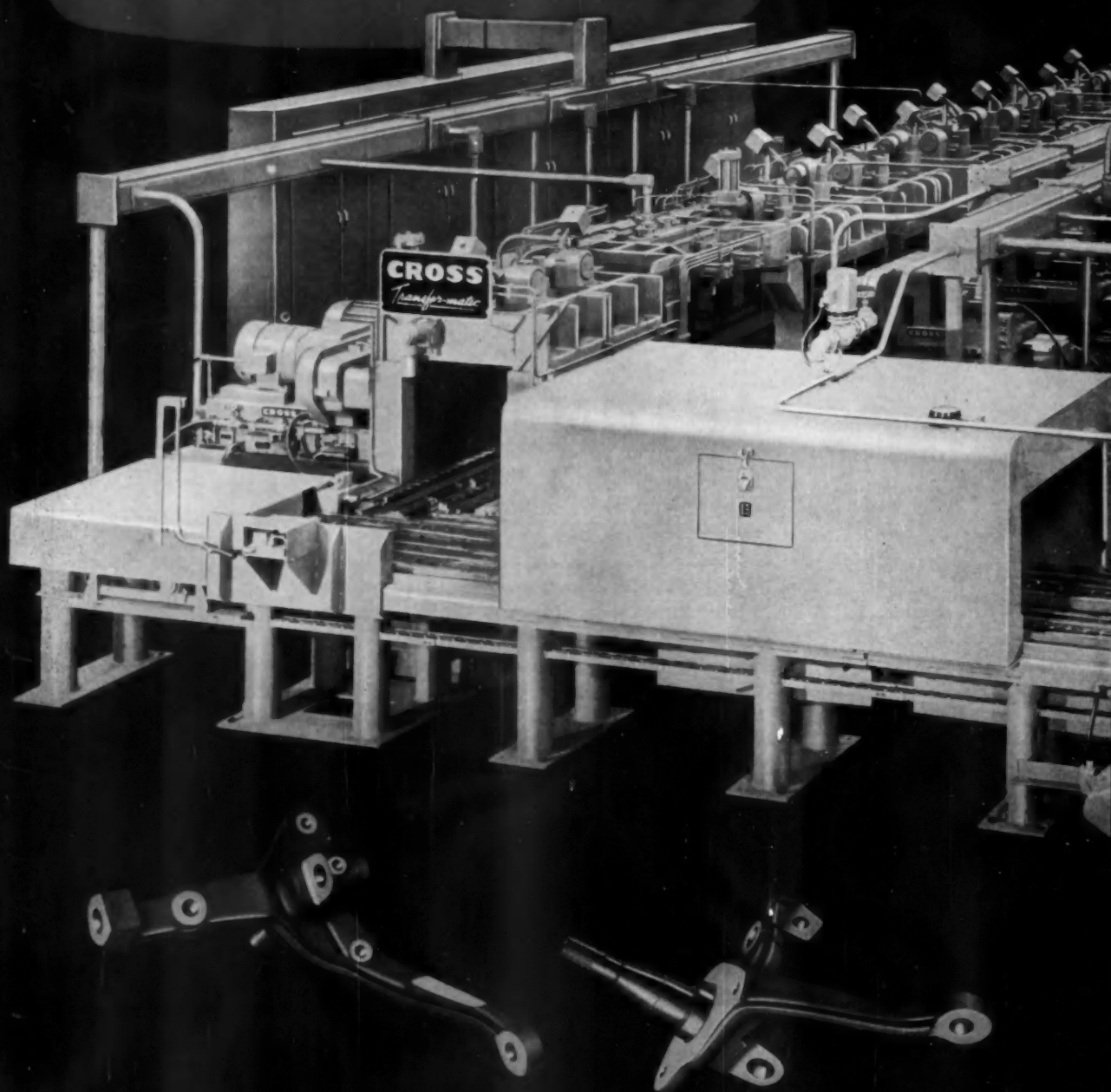
The machine tool builder defines the sequences in metal removal, the speeds and feeds. The “autometrologist” is responsible for the choice and combination of sensing, measuring, prediction, feedback, machine control and assembly operations.

Before embarking on your automated project, take advantage of Sheffield's extensive experience in “Autometrology”. It will save much valuable time and reduce operating cost. Write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 4.

**AUTOMETROLOGY—The science of combining machining, motion or memory with automatic measuring.*

7709

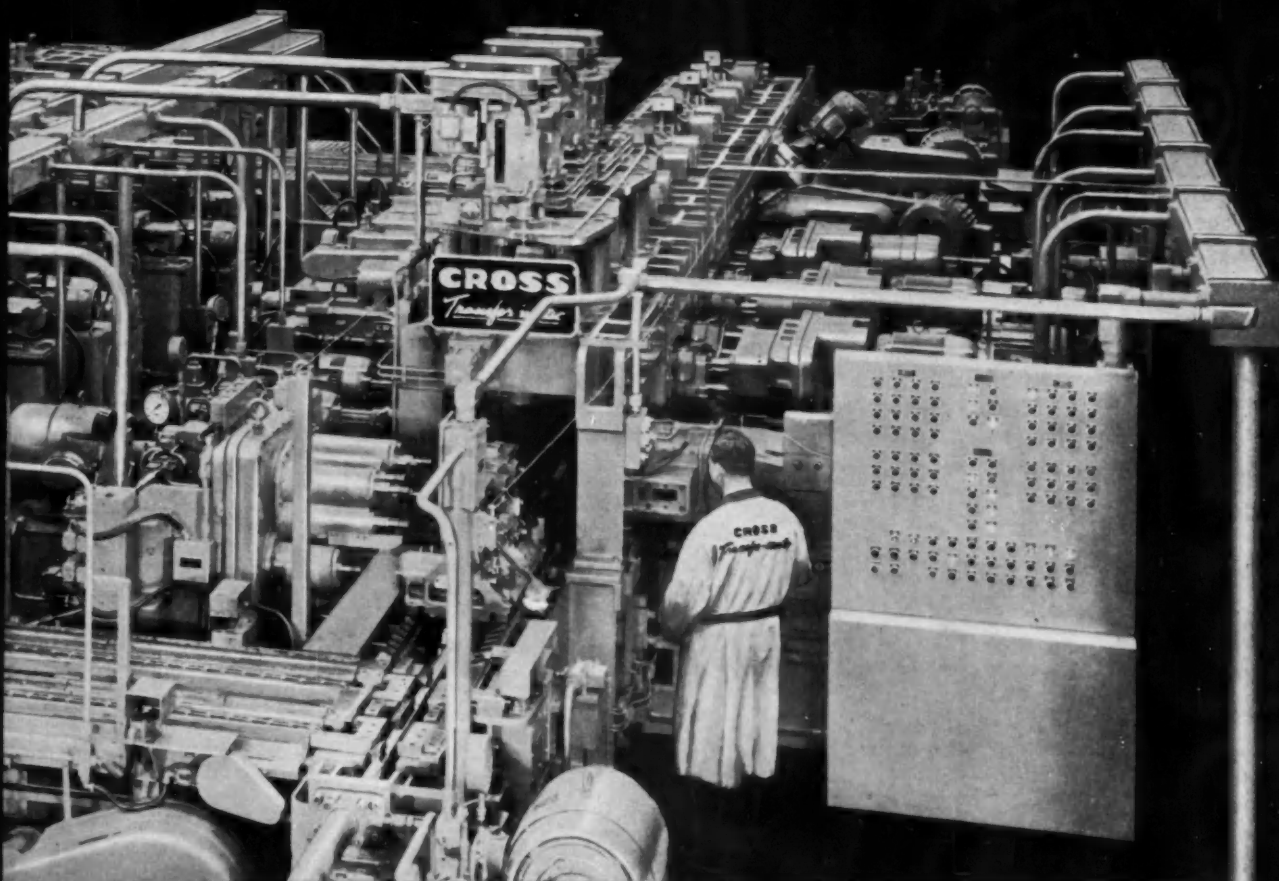
**Mills, Drills, Reams, Threads
Integral Front Wheel Spindle
and Steering Arm**



Established 1898

THE **CROSS** CO.
First in Automation
PARK GROVE STATION • DETROIT 5, MICHIGAN

Another Transfer-matic by Cross



- ★ Straddle mills upper and lower support arm bosses; straddle mills steering arm boss; mills steering arm stop pad; mills spindle keyway; drills and taper reams upper and lower support arm holes and steering arm hole; drills, reams, chamfers and spotfaces two brake mounting plate holes; drills, counterbores, spotfaces, chamfers and reams brake anchor hole; drills spindle cotter pin hole; and threads wheel spindle.
- ★ 144 right and 144 left hand parts per hour at 100% efficiency.
- ★ Pallet type work holding fixtures locate parts from spindle bearing diameters.
- ★ Power wrench clamps work holding fixtures automatically.
- ★ Gravity operated cam clamps for the work holding fixtures.
- ★ Automatic transfer mechanism indexes right and left hand parts through all 17 stations in pairs.
- ★ Automatic indexing units turn fixtures 82° at Stations 11 and 17.
- ★ Cross modular unit construction provides flexibility for design changes.
- ★ Other features: construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; complete interchangeability of all standard and special parts for easy maintenance.

How new cushioning medium

—and provides new **R-O-O-M**
for comfort and sales!

PROGRESSIVELY LOWER body design is building progressively bigger headaches among seating designers.

But not for those who know AIRFOAM is a *designing aid*—worlds above and beyond mere cushioning alternates.

For full-depth AIRFOAM, molded to your specifications, is a completely different — astoundingly versatile — *new medium of space engineering*. It frees good designers from the old no-can-do—it eliminates need for bulky components.

When you work closely with AIRFOAM Development Engineers, you can give free rein to your thinking — and Dream Seats become practical, economical selling aids.

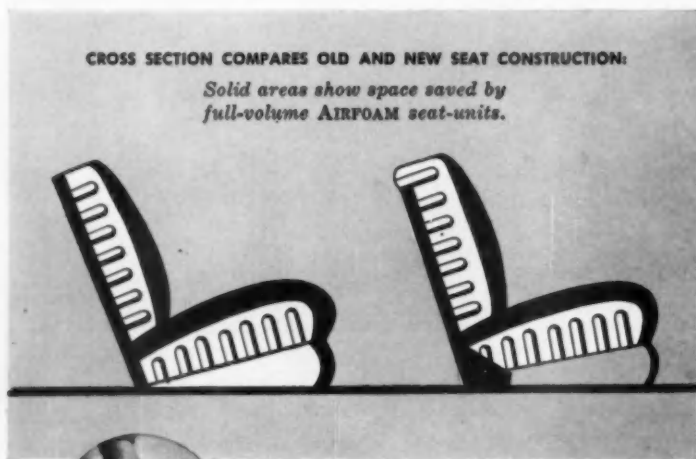
Got any really *wild* ones? Maybe we can help you tame 'em without breaking their spirit. We've done it for some of the best names in the industry. Goodyear, Automotive Products Dept., Akron 16, Ohio.

*Can continuous
cushioning make
this turn?*

*YES. With
Airfoam it's simply
a molded projection
of seat cushion.*

CROSS SECTION COMPARES OLD AND NEW SEAT CONSTRUCTION:

*Solid areas show space saved by
full-volume AIRFOAM seat-units.*



Airfoam

MADE ONLY BY **GOOD YEAR**

THE WORLD'S FINEST, MOST MODERN CUSHIONING

Airfoam—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

helps designers' dreams come true

Can you avoid a hard edge here?

YES. Molded Airfoam headrest (movable if desired) needs no edge-bracing.

Can you maintain a straight edge here?

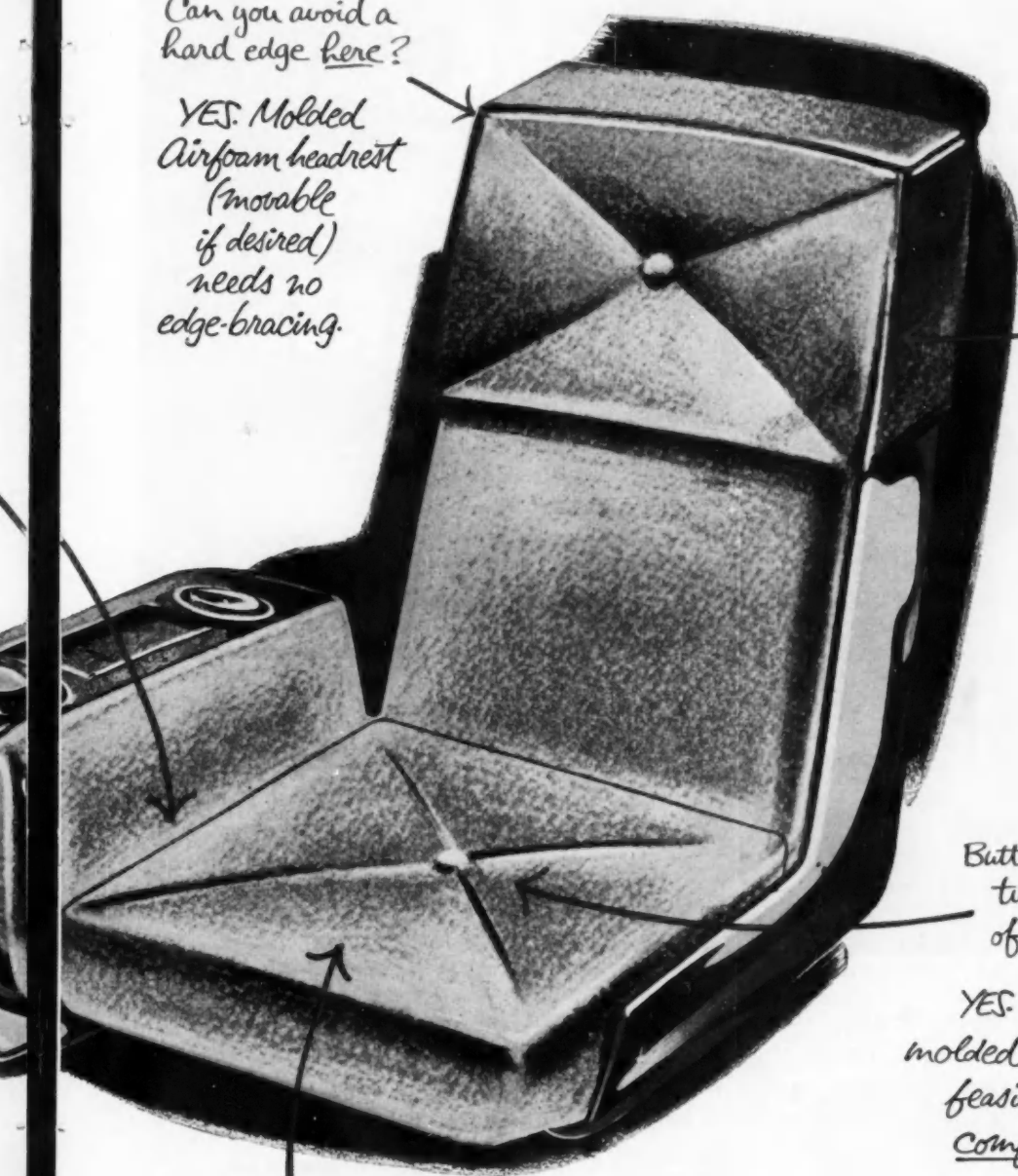
YES. With full-depth Airfoam it's molded in.

Button and biscuit tufting here of all places?

YES. With fully molded Airfoam it's feasible and comfortable!

Can you get this flat look without losing depth?

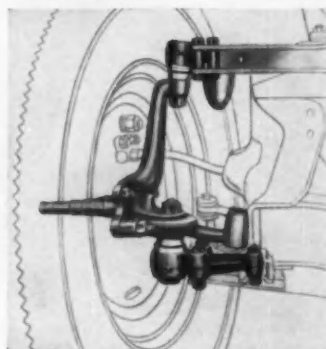
YES. Airfoam molded forms retain any desired shape.



MORE AND MORE CAR MAKERS JOIN THE SWING TO BALL JOINTS



Thompson ball joints permit both right and left steering and up-and-down motion of the wheels on ball or spherical bearing surfaces. This advanced front suspension principle not only makes steering safer and easier, it also allows valuable extra space for larger engines; for more functional chassis design for future trends in styling.



Ten cars now feature front suspension ball joints on their sparkling new 1957 models. This advanced Thompson Products engineering improvement helps cars hug the road, makes steering easier and safer.

The development and mass production of this revolutionary new product is a typical example of Thompson's side-by-side co-

operation with our customers. For more than 50 years Thompson has been a leading original equipment supplier to the American car, truck and farm implement industries.

Why not call on Thompson's engineers to help you with your steering and suspension problems. Write, wire or phone Thompson Products, Inc.,

Michigan Division, 34201 Van Dyke, Warren, Michigan.

You can count on



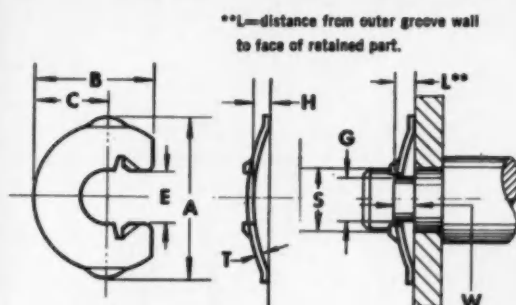
**Thompson
Products**

Michigan Division:
Warren and Portland

New Waldes Truarc locking-prong ring functions as spring, shoulder, fastener...and STAYS PUT!



Above assembly shows how 2 Waldes Truarc Locking-Prong Rings (Series 5139) replaced 6 parts...eliminated threading operation... and need for skilled labor.



WALDES TRUARC LOCKING-PRONG RING (Series 5139)

U. S. Pat. Pending

Ring No.	SHAFT		RING DIMENSIONS												average ultimate shear strength lbs.*	GROOVE DIMENSIONS					resilient end play take up L max. L min
	Dis. S	tol.	A	tol.	B	tol.	C	tol.	E	tol.	H	tol.	T	tol.†		Dis. G	tol.	Width W	tol.	L min.	
5139																					
12	.125	±.002	.340	±.010	.307	±.010	.166	±.005	.086	±.004	.050	±.010	.010	±.0013	400	.082	±.0015	.045	±.005	.035 .045 .010	
*15	.156	±.003	.380	±.010	.330	±.010	.184	±.005	.108	±.004	.055	±.010	.010	±.0013	600	.104	±.002	.050	±.005	.035 .045 .010	
18	.188	±.003	.445	±.010	.390	±.010	.213	±.005	.130	±.005	.060	±.010	.015	±.0015	900	.124	±.002	.065	±.005	.045 .055 .010	
25	.250	±.003	.581	±.010	.500	±.010	.280	±.005	.172	±.005	.070	±.010	.015	±.0015	1000	.165	±.002	.070	±.005	.050 .065 .015	
31	.312	±.003	.744	±.010	.620	±.010	.360	±.005	.234	±.005	.095	±.010	.018	$\frac{+.001}{-.002}$	1300	.228	±.003	.080	±.005	.080 .095 .015	
*37	.375	±.003	.853	±.015	.740	±.010	.427	±.005	.280	±.005	.130	±.010	.020	±.002	1900	.270	±.003	.105	±.005	.090 .115 .025	
*43	.438	±.003	.960	±.020	.820	±.020	.475	±.010	.337	±.010	.130	±.010	.020	±.002	2200	.327	±.003	.105	±.005	.095 .120 .025	

Additional Sizes Under Development

*Production dies not available as of date of printing

†Applies to unplated rings only

*Recommended safety factor = 3 to 4.

The Waldes Truarc Locking-Prong Retaining Ring is a new, low cost, radially applied fastener which can be locked positively in its groove and used as a shoulder against rotating parts. It is primarily intended for use in the automotive, electronic and aeronautical industries.

This radially applied ring locks positively in its grooves by means of two prongs at the open end. Because of its high thrust-load capacity the Waldes Truarc Locking-Prong Ring may be used as a shoulder against rotating parts. Its bowed construction provides for end-play take-up in the assembly and makes less critical the tolerances required for the parts being fastened. Since it serves as a spring as well as a shoulder, this ring eliminates the need for springs, washers, and other accessory fastening devices.

Whatever you make, there's a Waldes Truarc Retaining Ring

designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.



SEND FOR FREE SAMPLES

WALDES TRUARC

RETAINING RINGS

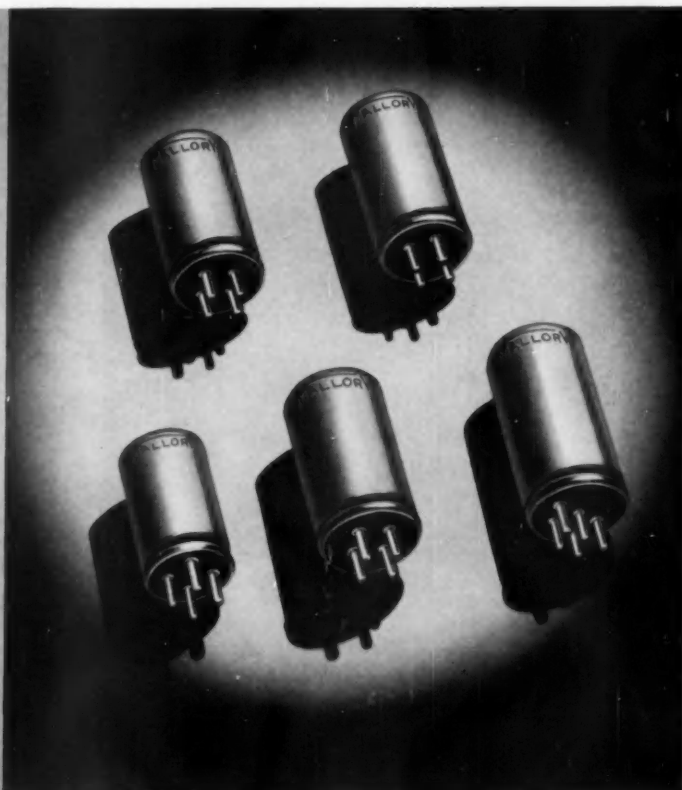
Waldes Kuhnauer, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.

- ☐ Please send me sample Locking-Prong Rings.
(Please specify shaft size.)
- ☐ Please send me supplement No. 1 which brings Truarc Catalog RR 9-32 up to date.
(Please print)

Name _____
Title _____
Company _____
Business Address _____
City _____ Zone _____ State _____ AY 046

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,493,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

New MALLORY Vibrator Designs



Give More and Better Service

No matter how heavy or light the load—or what the class of duty, there's a Mallory vibrator designed for maximum service to your specific requirements.

Mallory vibrators use a new concept in contact design to improve the contacts, reduce arcing, give faster starts, quiet mechanical noise, and give up to 100% more life. Spacing changes and erosion are greatly reduced. Contact transfer is virtually non-existent—heat dissipation is greatly improved.

● INTERRUPTER TYPES

- 1600 series—light to medium duty—shunt drive—automotive and electronics
- 1500 series—medium to heavy duty—separate drive—communications and electronics
- 1700 series—heavy duty—separate drive—split reed—communications and electronics
- 1750 series—heavy duty—separate drive—duplex operation—communications and electronics

● SELF-RECTIFYING TYPES

- 1800 series—nominal duty—shunt drive—for high efficiency and low space requirements
- 1850 series—nominal duty—separate drive—for high efficiency and low space requirements

Check the Mallory line for your vibrator requirements—or consult a Mallory engineer with your application details. Complete technical data is available.

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

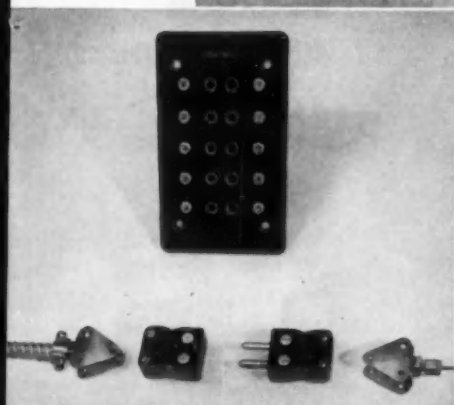
Parts distributors in all major cities stock Mallory standard components for your convenience.

Expect more...Get more from

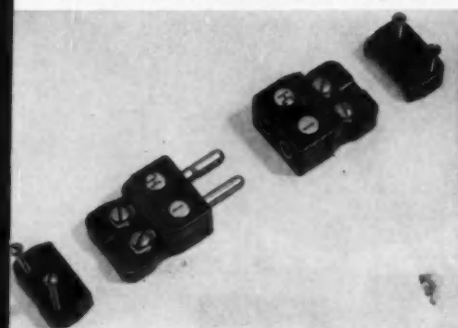
P. R. MALLORY & CO. Inc.
MALLORY

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Quik-Konnect jacks and plugs are marked with identification of insert alloy. Plug points are of different diameters for negative and positive poles, to prevent improper connection.



The Quik-Konnect Components consist of (left to right) cable clamp, jack, plug, and tube connector, and (above) jack panel which can be mounted in conduit box or control panel.



Only the terminal cover at the rear of the connector need be removed during connection of wires.

WITH these new Quik-Konnect Components you can make single, multiple or selective manual connection of a group of couples to an instrument. No handling of small parts. No confusing snarls of loose wire.

All assemblies are integral units. You can use them for quick extension wire connections in a laboratory or test cell, or for convenience and certainty of proper connections in permanent or semi-permanent installations.

Honeywell's new Quik-Konnect^{*} Thermocouple Components cut installation time 75%

... available through your



Plug and jack assemblies have inserts or points made from the thermocouple alloys to which they should be connected. Available in four standard T/C combinations. For complete details, call your nearby HSM (Honeywell Supplies Man). He's as near as your phone; or write for S005-1 specification sheet.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.



MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

^{*}Trade name of Minneapolis-Honeywell Regulator Co.

First in Controls

QUALITY



TRACTO

CATERPILLAR Massey-Harris

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The OHIO RUBBER Co.

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CASE.

FAIRBANKS-MORSE



ROTO-SPEED



Your high grade machines deserve MECHANICS Roller Bearing UNIVERSAL JOINTS quality. You can benefit from the protection and convenience of "once-a-season" or "lifetime" lubricated MECHANICS roller bearing universal joints — and still have the economy of stamped yoke construction. Let our engineers show you how MECHANICS Roller Bearing UNIVERSAL JOINT developments will give your machines competitive advantages.

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TRACTOMOTIVE



the WYATT line...

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Export Sales: Borg-Warner International • 36 So. Wabash, Chicago 3, Illinois



JACKSON

MECHANICS

Roller Bearing

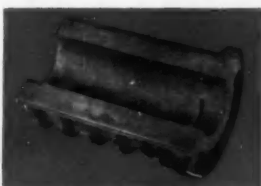
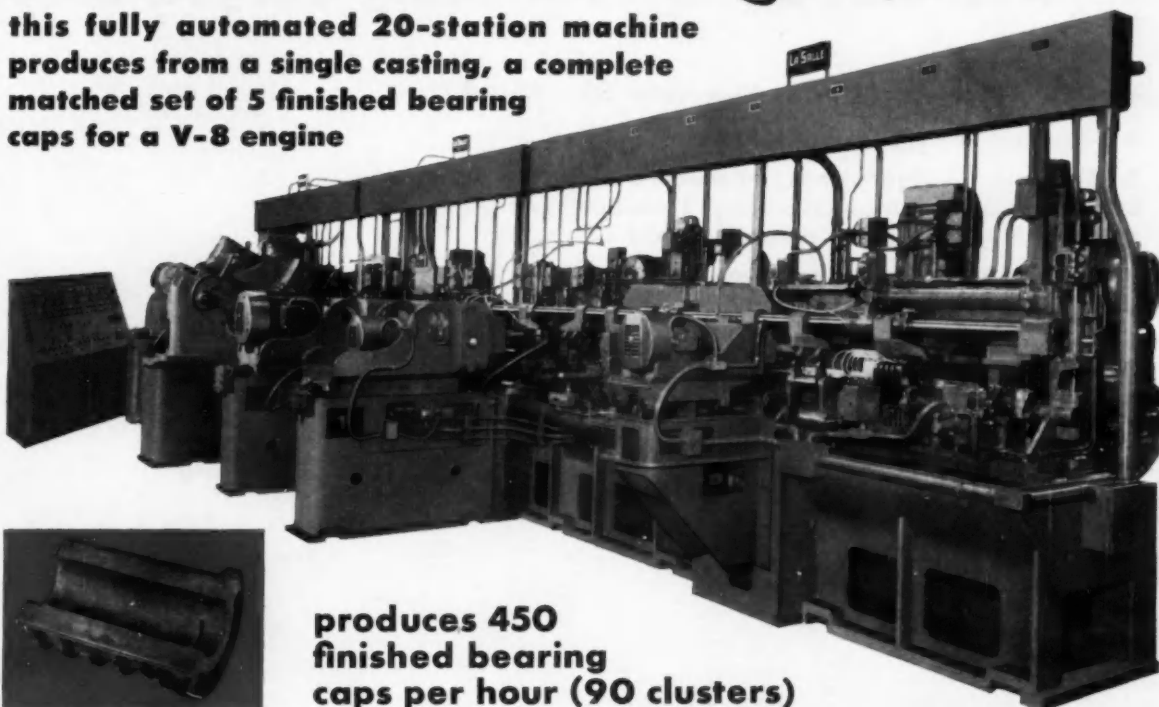
UNIVERSAL JOINTS



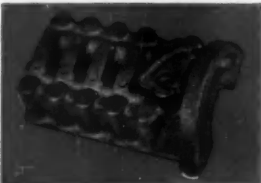
For Cars • Trucks • Tractors • Farm Implements • Road Machinery •
Aircraft • Tanks • Busses and Industrial Equipment

La Salle bearing-cap-automatic

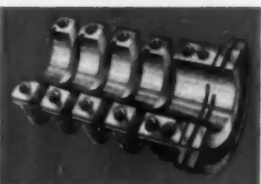
this fully automated 20-station machine produces from a single casting, a complete matched set of 5 finished bearing caps for a V-8 engine



Joint Face Side (Rough)



Rough Cluster



Joint Face Side (Finished)



Finished Cluster

**produces 450
finished bearing
caps per hour (90 clusters)**

1. The bearing cap cluster is shuttled into the load station, then rotated 90° so that the joint face is in a vertical plane. The part is then shuttled through the machine using one edge of the channel fit for vertical location and the joint face for in and out location.
2. End wise location is taken with a vee block on bearing cap No. 3—Then the part is clamped.
Right hand operation is to mill bearing cap cluster to length—Both ends. Left hand operation—drill (4) 1/2 Dia. Holes through.
3. Clamp: Right hand operation—Probe 4 drilled holes.
Left hand operation—Idle.
4. Locate from drilled hole—bearing cap No. 5 and clamp.
Right hand operation—Mill oil pump Pad No. 5 Vertical.
Left hand operation—Ream 2 holes bearing cap No. 3 and drill 4 holes.
5. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Idle.
Left hand operation—Drill 4 holes through and chamfer two holes in No. 5 bearing cap.
6. Clamp: Right hand operation—Probe 9 holes.
Left hand operation—Idle.
7. Locate from hole in bearing cap No. 5 and clamp.
Right hand operation—Drill one angular hole half way in oil pump pad bearing cap No. 5.
Left hand operation—Chamfer 9 holes.
8. Locate from reamed hole bearing cap No. 3 and clamp.
Right hand operation—Drill one angular hole to depth in oil pump pad bearing cap No. 5.
Left hand operation—Ream 8 holes.
9. Clamp: Right hand operation—Idle.
Left hand operation—Idle.
10. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Spot-face 6 bosses.
Left hand operation—Idle.
11. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Spot-face 4 bosses.
Left hand operation—Mill one 2" dia. by .120 slot in bearing cap No. 5.
12. Clamp: Right hand operation—Idle.
Left hand operation—Idle.
13. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Drill and counter-sink 2 holes in oil pump pad—counterbore oil pump shaft hole.
Left hand operation—Idle.
14. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Probe and blow out 2 holes in oil pump pad—Combination ream oil pump shaft hole.
Left hand operation—Mill one .120 slot and one .190 slot in bearing cap No. 5.
15. Clamp: Right hand operation—Idle.
Left hand operation—Idle.
16. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Idle.
Left hand operation—Mill 5 anchor slots.
17. Clamp: Right hand operation—Idle.
Left hand operation—Idle.
18. Locate from reamed hole in bearing cap No. 3 and clamp.
Right hand operation—Tap 2 holes in oil pump pad.
Left hand operation—Idle.
19. Locate from reamed hole in bearing cap No. 3 and clamp each of the 5 bearing caps independently.
Right hand operation—Idle.
Left hand operation—Mill 4 slots through bearing cap cluster, which divides cluster into 5 separate bearing caps. (Shuttle 5 separate bearing caps to station No. 20—).
20. Unload 5 separate bearing caps, maintaining separation.

La Salle tool, inc.

ENGINEERING & BUILDING
SPECIAL MACHINERY

3840 EAST OUTER DRIVE • DETROIT 34, MICHIGAN

AUTOMOTIVE INDUSTRIES, April 1, 1957

New Snyder Special Transfer Replaces Automation in Processing Forged Steel

Special Features of Snyder Machine No. 55-44

1. Production: 146 pieces per hour.
2. 26 Stations: 28 Operations per piece: 2 milling, 1 sawing, 4 hollow milling, 3 reaming, 1 countersinking, 10 drilling, 5 spotfacing, 1 threading and 1 tapping.
3. Palletized fixtures each carrying two parts.
4. Parts quickly and accurately clamped and located and unclamped by combination torque wrenches and hydraulically operated mechanisms at Stations 1 and 26.
5. Ten individual base segments provide maximum flexibility for future part design changes.
6. Ample room between segments for tool changes and maintenance.
7. Motorized fixture return conveyor with fixture washing unit.
8. Ample chip and coolant facilities.

Standard Features of Snyder Machines

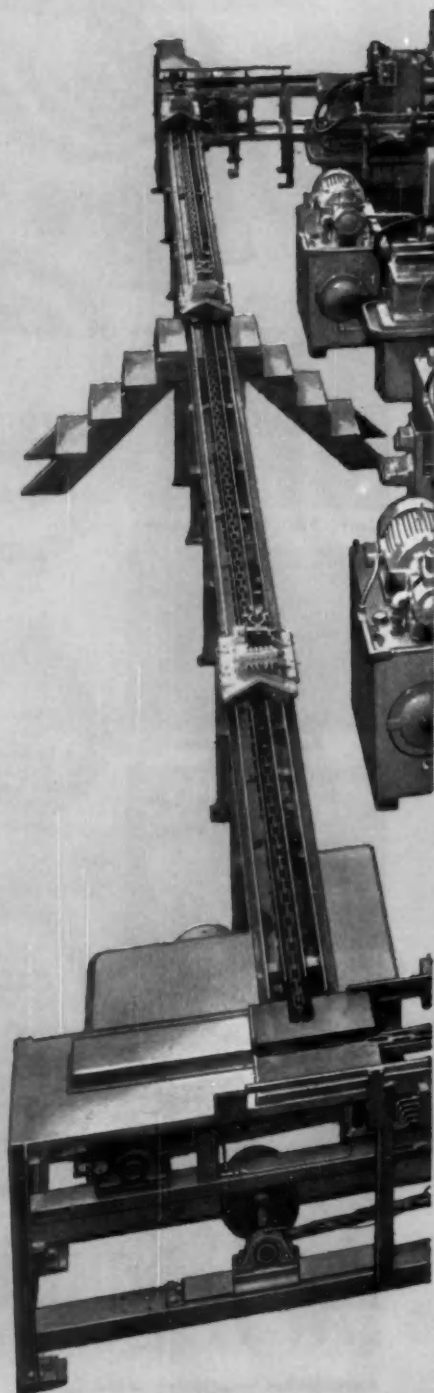
1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
6. Construction to J.I.C. Standards throughout.
7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

SNYDER

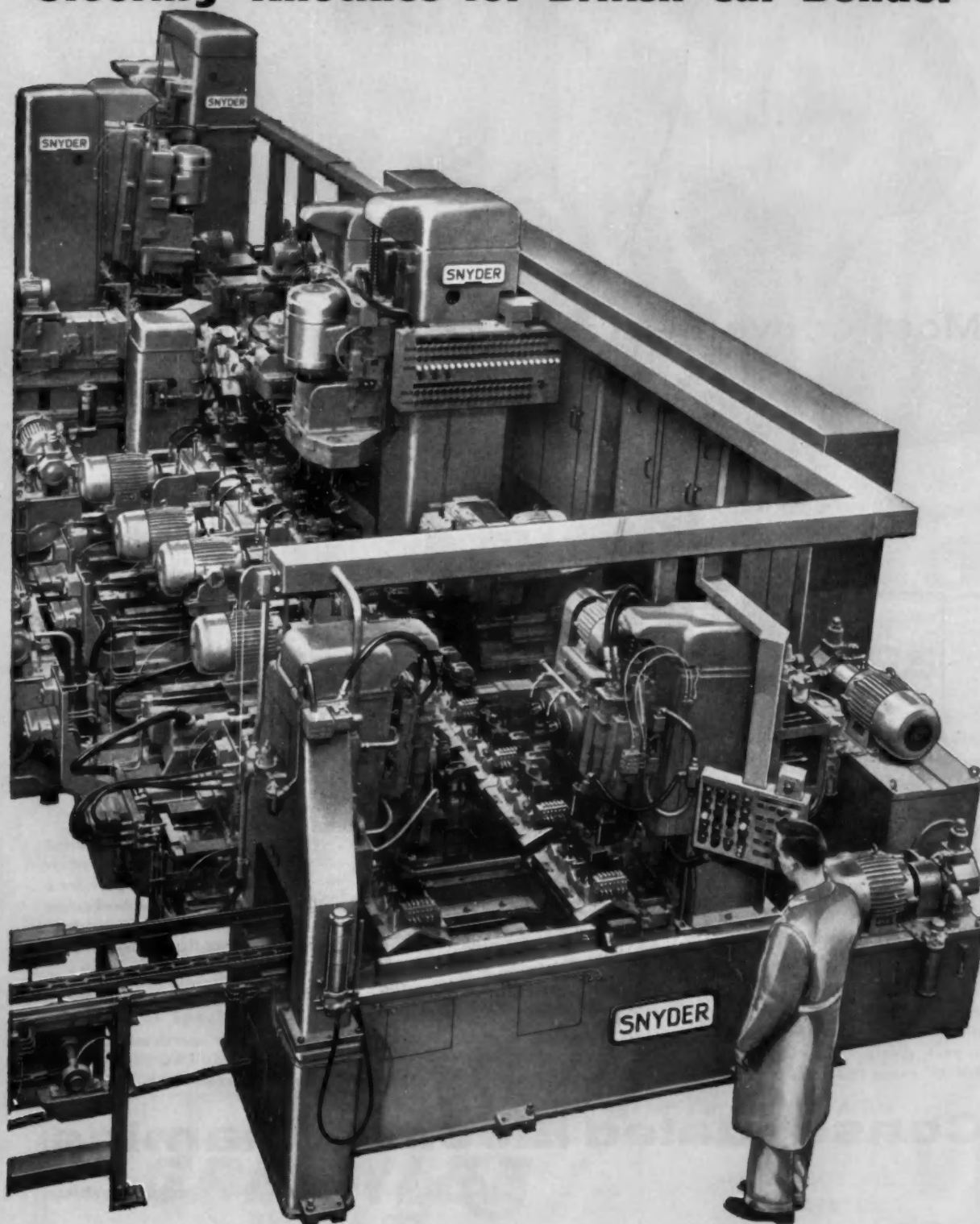
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

32 Years of Special Machine Tools with Automation



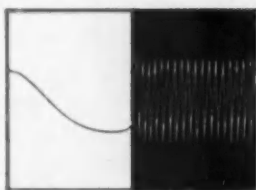
Several Semi-Standard Machines with Steering Knuckles for British Car Builder





Most convenient **vibration meter** available today

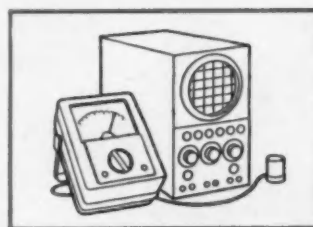
PORTABLE



FREQUENCY RANGE OF 10 TO 1000 CPS



TYPE 1-128



VERSATILE

You can carry this compact instrument *anywhere* for vibration analysis in either shop, field, or mobile applications. An *all-transistor, etched-circuit* design, the 1-128 Vibration Meter is battery-powered...weighs only 7½ lbs.

SELF-CONTAINED... With the addition of a linear or torsional vibration pickup, the convenient 1-128 becomes a completely self-contained monitoring system. Peak-to-peak displacements as small as 0.0005" cause full-scale indication.

Vibration displacements are accurately measured in the frequency range of 10 to 1000 cycles.

VERSATILE... An oscilloscope can be coupled to the meter through an output jack for visual waveform analysis. Simple to operate and designed to meet adverse environmental conditions, your CEC 1-128 will pay for itself many times over.

SAVES THOUSANDS OF DOLLARS... A large Los Angeles refinery is using the Consolidated 1-128 Vibration Meter to

monitor bearing vibration on sealed motor-driven pump units. With a vibration pickup, the instrument provides a convenient, highly dependable vibration monitoring system in this hazardous location...saves thousands of dollars in preventative maintenance.

For complete specifications, please write for Bulletin CEC 1566-X31, or contact your nearby CEC field office.

Consolidated Electrodynamics



300 North Sierra Madre Villa, Pasadena, California

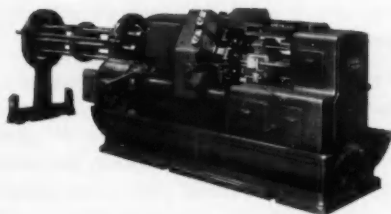
NATIONWIDE COMPANY-OWNED SALES & SERVICE OFFICES

**FROM DIESEL ENGINE TO
ICE-CREAM FREEZER PARTS**



AUTOMATIC BAR MACHINES

Handle All Types of Jobs



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

- ✓ **Efficiently...**
- ✓ **Economically**

Greenlee design permits the handling of a wide variety of operations at various spindle positions . . . makes it easier to split up long operations . . . reduces idling time.

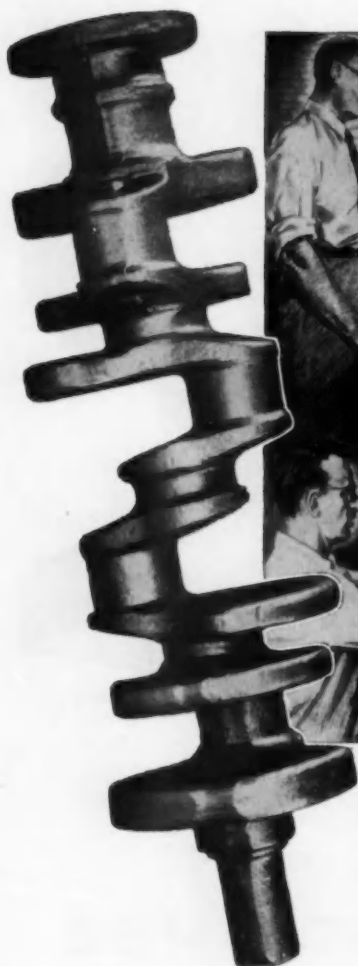
Threading, tapping and reaming can be performed in 3rd, 4th, 5th and 6th positions . . . a special Greenlee advantage. Seven full-length T-slots on the main tool slide will accommodate the tools and attachments needed for a wide range of set-ups. Interchangeable cross-slide tooling and simplified cross-slide camming contribute to greater flexibility and faster set-ups.

Investigate! Ask any owner or operator . . . they'll tell you that Greenlee is one of the most highly respected names in its field.

Write for Catalog No. A-405

GREENLEE
BROS. & CO.

1754 MASON AVE.
ROCKFORD, ILL.



There is NO SUBSTITUTE for a forging: NO SUBSTITUTE for Wyman-Gordon Experience

There is more to the superiority of the forged crankshaft than just strength.

No other method of fabrication can compare with the forging process for dependability. The uniformity and predictability of physical properties with minimum variance from piece to piece or from one location to another in the same piece is assured to the greatest degree by modern forging practice.

Top automotive engineers agree that the use of a forged crankshaft permits the design of a more compact engine which is

a decided advantage when thinking in terms of limited space available and overall engine weight reduction.

As compression ratios increase and engine outputs go up the risk factor must be reduced. Again, the uniformity of quality in the backbone of the engine, the crankshaft, is most essential and made possible only by a forging.

There is NO SUBSTITUTE for a forging and in a forging there is NO SUBSTITUTE for WYMAN-GORDON quality and experience.

WYMAN-GORDON COMPANY

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER 1, MASSACHUSETTS
HARVEY, ILLINOIS • DETROIT, MICHIGAN



For high-integrity fluid lines specify R/M FLEXIBLE THIN-WALL *Teflon* HOSE

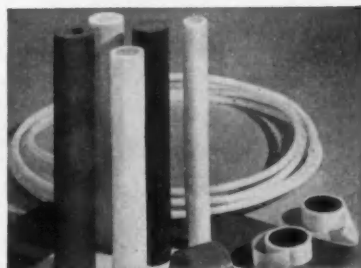
You can depend on R/M Flexible Thin-Wall "Teflon" Hose to withstand corrosive fluids, high mechanical stresses, and extreme ambient temperatures. In every application, it means an extra measure of safety and performance.

R/M's new hose — stainless steel wire-braided or rubber-covered — is extremely flexible and does not expand, contract or fatigue. It can be kept in continuous service at temperatures from -100° to $+400^{\circ}\text{F}$, and is chemically inert to hydraulic fluids and synthetic lubricants. Also it has a

very low coefficient of friction, reducing pressure drop in fluid systems to a minimum.

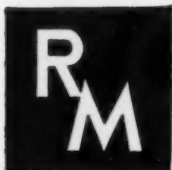
R/M Flexible Thin-Wall "Teflon" Hose is one of a large family of products developed by R/M engineers to take advantage of the unique properties of this material. Our long experience with "Teflon" is your best assurance of the highest quality.

This hose is available through leading coupling manufacturers. A list of suppliers and complete specifications will be furnished on request.



Other R/M "Teflon" products for the automotive and aviation industries include rods, sheets, tubes and tape; centerless ground rods held to very close tolerances; stress-relieved molded rods and tubes; Raylon — a mechanical grade of "Teflon" having many of the properties of virgin "Teflon." For details, call or write R/M.

*A Du Pont trademark



RAYBESTOS-MANHATTAN, INC.

PLASTIC PRODUCTS DIVISION, MANHEIM, PA.

FACTORIES: Manheim, Pa.; Bridgeport, Conn.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Engineered Plastics • Asbestos Textiles • Mechanical Packings • Industrial Rubber • Sintered Metal Products • Rubber Covered Equipment
Abrasive and Diamond Wheels • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Industrial Adhesives • Bowling Balls

Udylite Builds Largest Plating Installation On West Coast

Rheem Automotive Company greatly increases production capacity for automobile bumpers in completely new plant.

IN an orange grove setting, near Fullerton, California, Rheem Automotive Company now has in operation the largest plating installation on the West Coast. It was designed and built by the Udylite Corporation under the supervision of the L. H. Butcher Company Division. Udylite furnished a complete "package" for the cleaning and plating facility.

Rheem manufactures the complete bumper right from panels of high tensile steel. Before plating, these panels are pickled, polished, bonderized, rinsed, formed and then transferred by an overhead monorail system to the plating department. Here in an area the size of a football field the bumpers travel through thirty-one operations.

Upon arrival at the plating department, ten to sixteen bumpers are placed on each rack in a floor level racking area. The racks, mounted on work carriers, are delivered automatically to the Udylite pre-plate unit by the monorail system. This automatic machine is 133' long x 15' wide x 22' high. It operates hydraulically and routes the work through a pre-plate cycle including cleaning, spraying, acid dip and nickel strike.

After the cleaning and surface preparation, the work carriers with their racks of bumpers are delivered selectively to either of the two nickel

plating lines where they are then placed in the nickel plating tanks on a predetermined time cycle.

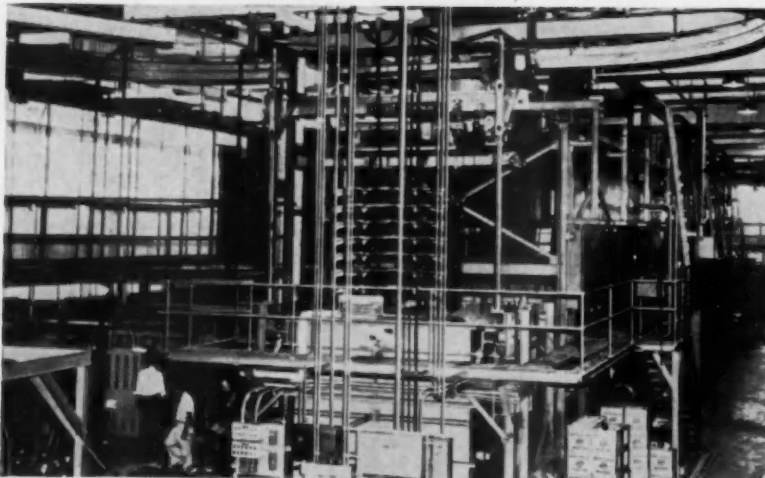
The nickel line consists of two sections, each composed of sixteen tanks; twelve contain nickel plating solutions. Each nickel plating tank has conforming anodes and cathode bar agitation and contains 3,750 gallons of solution which is continuously filtered and heated by heat exchangers. Each tank is powered by a 5,000 ampere, 18 volt Udylite-General Electric Germanium rectifier with automatic stabilized voltage control.

Work carriers are picked up at the end of the nickel line and are transferred to inspection stations by means of the continuous monorail system, prior to final chromium plating.

After inspection, work carriers are automatically delivered to the chromium plating line and handled by a manually operated monorail system through a series of ten cleaning, rinsing and chromium plating tanks.

Then, after chromium plating, the work carriers are automatically picked up and delivered to an unloading area where the plated bumpers are removed for inspection and palletizing.

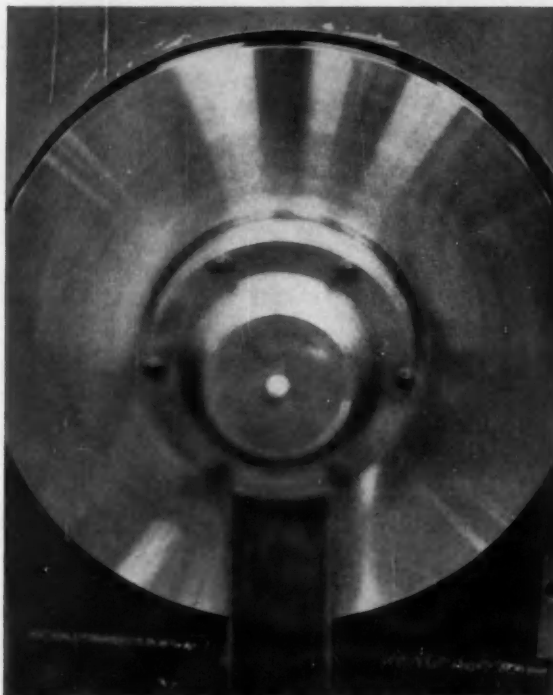
The new Rheem facilities are said to greatly increase plating capacity for automobile bumpers.



Bumpers loaded on plating racks are automatically transferred through this seventeen tank pre-plating unit giving chemically clean surfaces prior to nickel plating.

CALENDAR OF COMING SHOWS AND MEETINGS

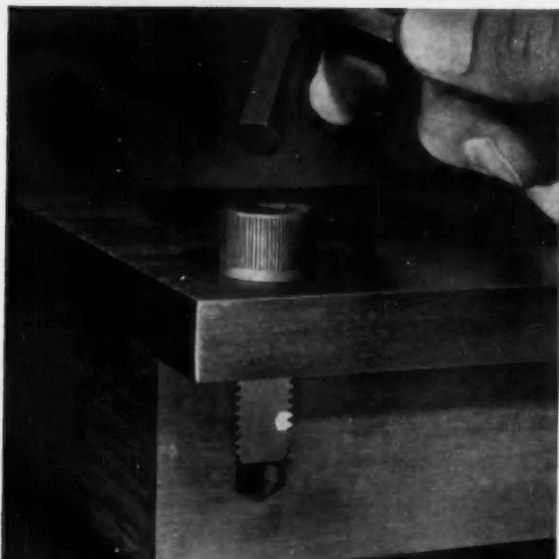
- ASME Instruments & Regulators Conference, Northwestern Univ., Chicago, Ill.Apr. 7-10
- National Screw Machine Products Association, spring meeting, Shoreham Hotel, Washington, D. C.Apr. 7-11
- Metal Treating Institute, annual spring meeting, Boca Raton Hotel, Boca Raton, Fla.Apr. 8-10
- ASME Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.Apr. 8-10
- National Packaging Exposition and Conference, Chicago, Ill.Apr. 8-11
- American Welding Society, national spring meeting and fifth welding and allied industry exposition, Philadelphia, Pa.Apr. 8-12
- Conference on Electronics in Industry, Ill. Institute of Technology, Chicago, Ill.Apr. 9-10
- Sixth Electrical Engineers' Exhibition, Earls Court, London.Apr. 9-13
- Association of Lift Truck and Portable Elevator Manufacturers, Edgewater Beach Hotel, Chicago, Ill.Apr. 11
- U. S. World Trade Fair, Coliseum, New York, N. Y.Apr. 14-27
- Mobilgas Economy Run, Los Angeles to Sun Valley, Idaho.Apr. 14-18
- Aircraft Ball Bearing Conference, sponsored by New Departure Div. of General Motors Corp., Statler Hotel, Hartford, Conn.Apr. 16-17
- Lead Industries Association, annual meeting, Drake Hotel, Chicago, Ill.Apr. 24-25
- National Industrial Research Conference, Conrad Hilton Hotel, Chicago, Ill.Apr. 24-25
- U. S. Chamber of Commerce, 45th annual meeting, Washington, D. C.Apr. 29-May 1
- Materials Handling Exposition and Conference, Philadelphia, Pa.Apr. 29-May 3
- Metal Powder Association, annual meeting and show, Drake Hotel, Chicago, Ill.Apr. 30-May 1
- Engineered Castings Show, Cincinnati, O.May 6-10
- Industrial Tool and Production Show, Toronto, CanadaMay 6-10
- British Industries Fair, Birmingham, EnglandMay 6-17
- AIEE Aircraft Meeting, Biltmore Hotel, Dayton, O.May 7-9
- American Helicopter Society, annual forum, Sheraton - Park Hotel, Washington, D. C.May 8-11
- Fluid Control Institute, spring meeting, Greenbriar, White Sulphur Springs, W. Va.May 8-11
- Tokyo Motor Show, JapanMay 10-19
- American Institute of Industrial Engineers, annual conference and convention, Hotel Statler, New York, N. Y.May 16-17
- Design Engineering Conference and Show, Coliseum, New York, N. Y.May 20-22
- Fabricating Machinery Hydraulic Conference, sponsored by Vickers, Inc., Sheraton Cadillac Hotel, Detroit, Mich.May 21-22
- American Society for Quality Control, convention and exposition, Masonic Temple, Detroit, Mich.May 22-24
- National Automotive Service Show, Boston, Mass.May 23-26
- Paris Air Show, FranceMay 24-June 2
- Indianapolis Race, Ind.May 30
- SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.June 2-7



Self-locking UNBRAKO socket screws keep critical adjustments secure in the eccentric drive mechanism of this fatigue testing machine. Drive system delivers varying loads up to 15,000 pounds force to equipment under test at 1050 cycles per minute.

Vibration won't loosen Self-locking UNBRAKO socket cap screws

Screws with Nylok* device permit adjustments, keep precise settings during long test runs



HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together, and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok self-locking device stay tight under constant vibration.

Take the eccentric drive system in the fatigue testing machine illustrated above, for example. This machine must frequently run for periods up to 2 weeks or longer, day and night, to complete a single test. Loosening of the screws which are used to adjust the tension-setting mechanism could not only cause damage to the machine, but also make the test data worthless. Self-locking UNBRAKO socket head cap screws eliminate such problems.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or pounding, or endless running of a machine, won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives complete catalog and technical data on the entire line of UNBRAKO socket screws with the Nylok self-locking device. Or see your authorized industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

UNBRAKO SOCKET SCREW DIVISION

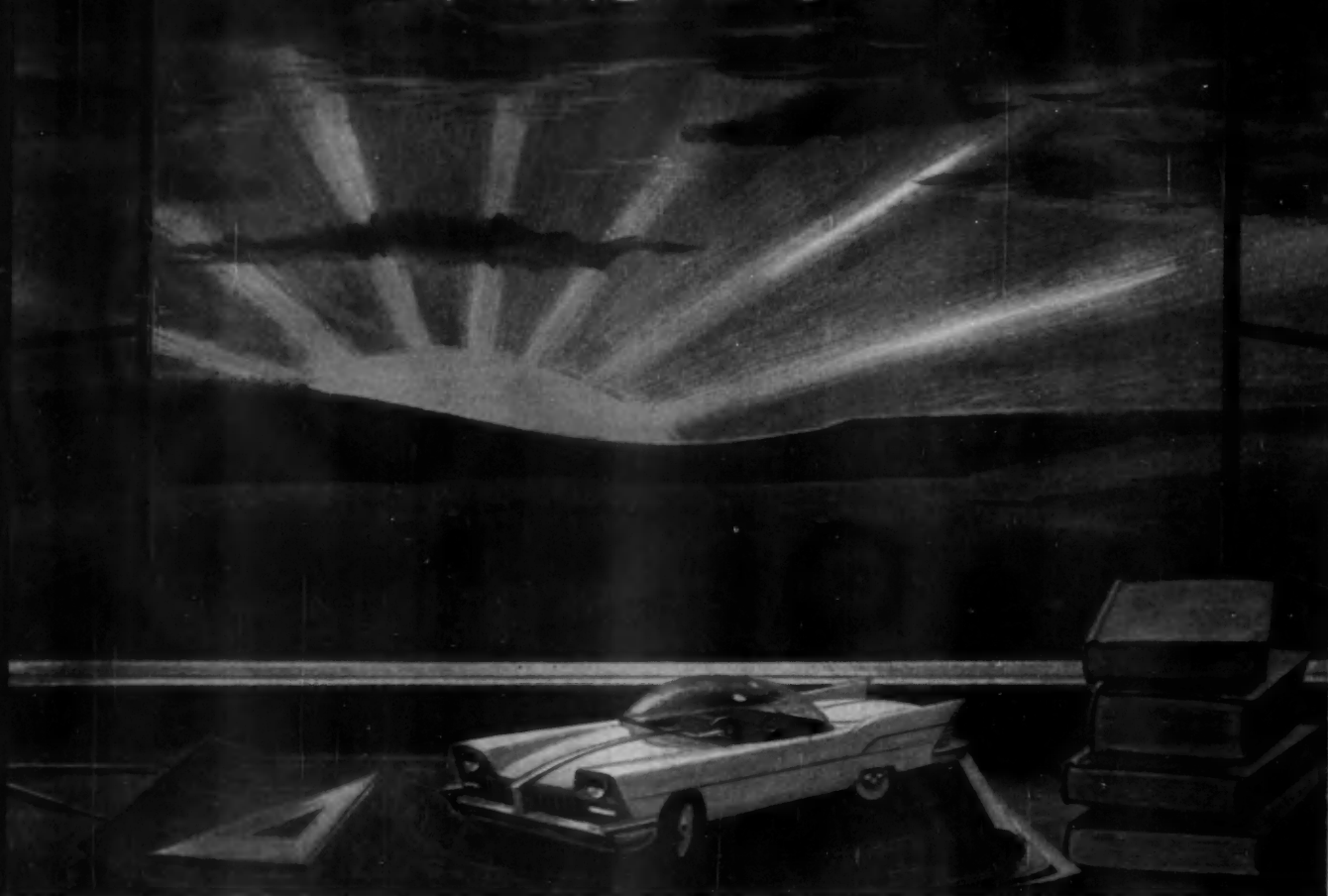
STANDARD PRESSED STEEL CO.

SPS

*T.M. Reg. U.S. Pat. Off. The Nylok Corporation

JENKINTOWN PENNSYLVANIA

VISION



LOOKING TO THE FUTURE—PRODUCING FOR TODAY!

Progress has been the keynote of the automotive industry. Today's achievements are but challenges for the accomplishments of tomorrow.

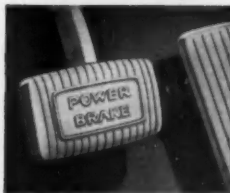
Over the years Bendix Products Division has contributed significantly to automotive progress. From four wheel brakes to power braking and power steering, Bendix has pioneered and developed many of the industry's most notable advancements.

And today Bendix Products Division is planning new and better products for the cars and trucks of tomorrow.

That's why the industry looks to Bendix* as a source of new ideas, as well as a volume manufacturer of automotive components.

*REG. U.S. PAT. OFF.

TYPICAL EXAMPLES



Bendix Power Brakes



Bendix Power Steering

BRAKES • POWER STEERING • POWER BRAKING
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John F. Pfeffer, Asst. to Publisher
E. H. Miller, Advertising Mgr.
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REGIONAL MANAGERS

CHICAGO—William H. Baldwin
—Carl A. Zehner
360 North Michigan Ave.
Chicago 1, Ill.
Phone RAndolph 6-2144

DETROIT—Melvin B. Nylund
1015 Stephenson Bldg.
Detroit 2, Mich.
Phone TRinity 5-2090

PHILADELPHIA and NEW YORK—
Nelson W. Sieber
Chestnut and 56th Sts.
Philadelphia 39, Pa.
Phone SHerwood 8-2000
and
100 East 42nd St.
New York 17, N. Y.
Phone OXford 7-3400

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High Spots of This Issue

★ Car Suspension Era at Hand

Major topic of interest at the recent SAE National Passenger Car, Body and Materials Meeting was suspension design. Other timely subjects discussed were rear axles and electrical systems. Extracts of several papers are given here. Page 48.

★ New Semi-Automatic Truck Transmission

Minimal use of the gearshift lever and clutch pedal characterizes the new StepMatic developed by the Transmission Div. of Clark Equipment Co. Design and operation of the unit for heavy-duty trucks are described in this article. See Page 52.

★ Experimental Tractor Has Free Piston Engine

Tractor and Implement Div. of Ford Motor Co. recently took the wraps off its new experimental Typhoon tractor. First of its type to be powered by a free piston turbine engine, it appears to bear great promise for the future. See Page 54.

★ Extensive Conveyor Systems at Thompson Products

Representing both in layout and equipment careful pre-planning, the new plant of the Michigan Div. of Thompson Products has many advanced features. Particular emphasis has been laid on conveyor systems and automation techniques. Page 56.

★ Effects of Local Loads in Sandwich Structure

The development of sandwich-type skins was a boon for aircraft control surfaces, but compressive strength remained a problem insofar as high local loads were concerned. Various methods by which this difficulty is being met are discussed. Page 70.

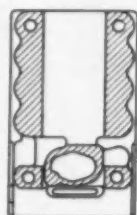
★ 36 New Product Items And Other High Spots, Such As:

Tire cord developments tested in modern laboratory; electrical discharge machining; testing ignition distributors; versatile air tools for aircraft production; and automatic machine for drilling and riveting.

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES
• BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY •
PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT
SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
ENGINEERING • PRODUCTION • MANAGEMENT

Big Cincinnati Hydro-Broach

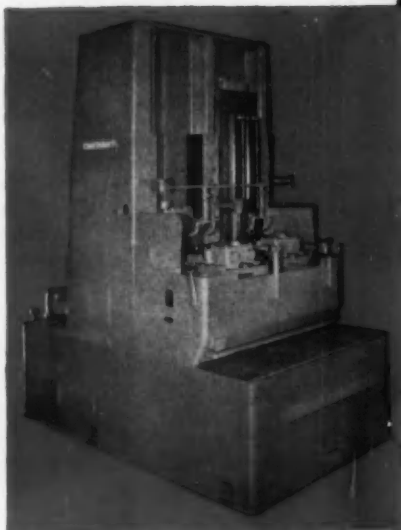
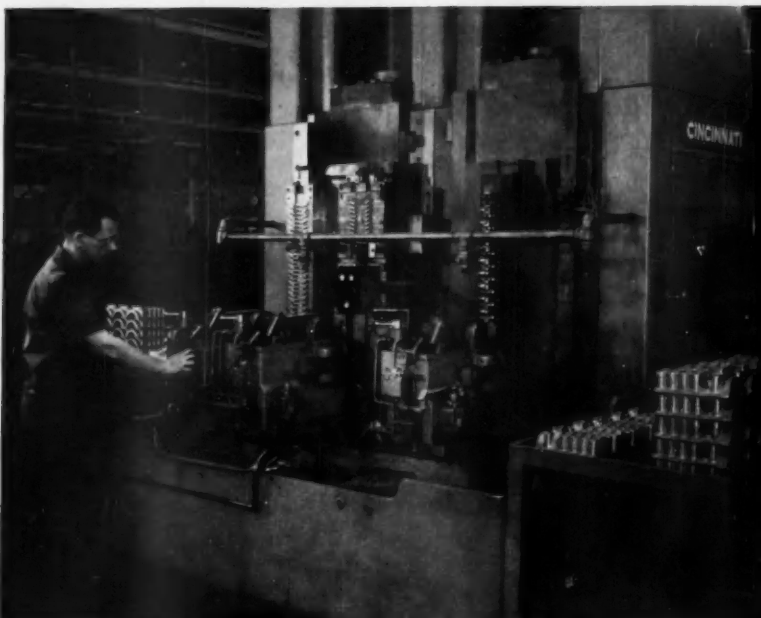
**Exerts 25 Tons Push
To Broach Bearing Cap Clusters**



**Drawing of part
showing surfaces broached**

Production data:

Part name . . . Bearing cap cluster
Material . . . Cast iron
Operation . . . Broach half bore, joint face,
bolt bosses, oil pump pad,
edges and chamfers
Machine . . . CINCINNATI® No. 25-66 Duplex
Vertical Hydro-Broach
Production . . . 70 per hour at 80% efficiency



CINCINNATI No. 25-66 Duplex Vertical Hydro-Broach Machine. Brief details will be found in Sweet's Machine Tool File.

Cincinnati builds them taller, but the Hydro-Broach illustrated here is no midget . . . it has 66" stroke and 25 tons push! That's a lot of vertical broaching capacity for any machine. ¶ This equipment is a complete production package, with tooling by Cincinnati Application Engineers to broach bearing cap clusters. The work progresses through three stations, from right to left. Right-hand fixture is a single station unit, and holds one casting for broaching the half bore. Left-hand fixture has two stations; one for broaching the joint face, edges and chamfers, and in the second station, bolt bosses and oil pump pad are broached.

To relieve the operator of unnecessary physical effort, both fixtures are hydraulically operated. Production averages 70 bearing cap clusters per hour at 80% efficiency.

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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 116, No. 7

April 1, 1957

Chrysler Sales May Top \$1 Billion In Quarter

Chrysler Corp. estimates its sales for the first quarter of this year may surpass \$1 billion. That would give the corporation its best three-month period on record. The report, due in mid-May, also may show earnings at a new high, exceeding the \$34.5 million in the 1955 quarter.

The continuing high rate of sales by all Chrysler Corp. divisions has prompted several company officials to raise their sights on sales and production for 1957. The most optimistic forecast comes from M. C. Patterson, president of Dodge Div. He predicts the corporation will take 25 per cent of the industry sales, with Plymouth contributing a majority of this increase. Dodge, he said, would boost its share considerably, from 3.9 per cent in 1956 to about 6½ or 7 per cent.

F. W. Misch, Chrysler's financial vice president, indicated the corporation would have no difficulty in achieving at least 20 per cent of the market, a share it held prior to 1954. Its current sales have been accounting for about 19 per cent of the market. Shipments of cars and trucks in the January-March quarter are expected to top 416,000, which would be surpassed only by the 456,000 in the first quarter of record 1955.

S-P Reports Operating Loss Of \$43.3 Million For 1956

Studebaker-Packard Corp. had an operating loss of \$43.3 million in 1956, a preliminary report shows. Containing only sketchy information about the company's operations last year, the report noted that the loss was incurred before special charges totaling \$60 million. It is understood that most of the special charges consisted of



MASERATI 200/SI SPORTS CAR IS BUILT FOR SPEED

Maserati of Italy has placed on the market this two-seater sports car with an aerodynamically styled body. The four-cylinder engine has a compression ratio of 9.30 to 1 and an output of 190 bhp at 7400 rpm. Wheelbase of car is 7 ft., 1.8 in.

reserves provided for consolidating manufacturing operations in South Bend, and plant and inventory obsolescence and depreciation.

In the last two months of the year, the company showed an operating profit of \$895,000. This helped to reduce the \$49.6 million operating loss incurred in the first nine months by \$6.3 million.

No full-year sales figures were given in the preliminary report. Sales for the nine-month period totaled \$227.4 million, down 47 per cent from the same period a year earlier.

Automobile production, which last year dropped 45 per cent under the 1955 total, got off to a slow start this year. It was down more than 50 per cent from a year ago.

During January and February, production ran at a rate far below that predicted by S-P officials a few months ago. The company is shooting for a production goal of 150,000 cars and trucks in 1957. For the first two months, total vehicle output amounted to slightly more than 15,000 units.

Ford Selects Five Plants For Assembly of Edsel Car

Ford Motor Co.'s upcoming new Edsel car will be assembled initially at Ford and Mercury plants in five cities. The Somerville, Mass., facility will be converted to the exclusive production of Edsel's two top lines—the Corsair and Citation.

Other plants which will assemble the Edsel are those located at Mahwah, N. J.; Wayne, Mich.; Louisville, Ky.; and Milpitas, Calif. In addition, another West Coast plant is yet to be selected in the Los Angeles area.

Sales of Armstrong Cork in '56 Close to All-Time Peak in '55

Armstrong Cork Co. in 1956 achieved sales within one per cent of the 1955 high.

Sales in 1956 were \$247,401,000 with net earnings of \$13,320,000 after provision for \$13,700,000 of Federal income taxes. This compares with sales of \$249,385,639 and earnings of \$14,542,289 in 1955.

News of the AUTOMOTIVE



LATEST JAGUAR HEADS FOR U.S. WITH NEW STYLING

Latest Jaguar 3.4-liter sedan retains the basic body of the existing model, but features a wider radiator grille and cutaway rear wheel shields. The 210-hp engine from the Mark VIII powers the 2800-lb car. Production has been resumed at Jaguar's fire-damaged factory in Coventry. Output of this model is destined for export to the U. S.

Borg-Warner Acquires Control Of Australian Parts Producer

Borg-Warner Corp. may step into the Australian market on a large scale with many of its automotive products. The company recently bought controlling interest in Coote & Jorgensen, Ltd., one of Australia's largest automotive parts makers.

Borg-Warner will provide the company with technical, financial, engineering, and production assistance in

the manufacturing of components and forgings for the Australian automobile industry. Future licensing agreements may be negotiated which would permit the Australian firm to make items which B-W now is producing in the U. S. These include automatic and standard transmissions, overdrives, torque converters, timing chains, sprockets, and other items.

Buick Adds Luxury Car To Roadmaster Series

Buick has added a fifth series of cars to its line-up. It is a luxury model called the Roadmaster 75. Offered in two- and four-door hardtop models, the new series is priced about \$400 above the Roadmaster 70. Suggested list prices are \$3978 for the two-door model and \$4080 for the four-door.

Except for tinted windshield and white sidewalls, all equipment is standard, including a six-way power seat and power windows. The 75 has the same wheelbase and overall length as the Roadmaster 70.

Main features are special interior appointments, such as chrome-plated instrument panel, extra-deep nylon carpeting, doors upholstered up to the windows, and special arm rests. These include individual cigarette lighters and ashtrays. A new engineering feature is aluminum front brake drums for improved cooling.

Cadillac Starts Shipments Of Brougham To Key Cities

Shipments of Cadillac's Eldorado Brougham to dealers in key cities began last month. The car will be shown publicly by individual dealers as they receive them. Carrying a price tag of \$13,500, about \$300 above Ford's Continental Mark II, the Brougham features numerous items as standard equipment, including all power assists, air conditioning, and the first air suspension system ever offered on a production model.

Mobilgas Economy Run Planned For Dates of April 14 thru 18

The 1957 Mobilgas Economy Run is scheduled for April 14 to 18 over an as-yet-undetermined route from Los Angeles, Calif., to Sun Valley, Idaho. As in the past, winners will be named in four price classifications; low-price; low-medium; upper-medium; and high-price. Class winner with the top fuel economy record will be judged the sweepstakes champion.

All cars entered in the contest will be four-door sedans or two- and four-door hardtop models. Only cars equipped with automatic transmissions may be entered.

FORD AND PLYMOUTH CUT INTO CHEVROLET PERCENTAGE 1957 New Car Registrations*

Arranged by Makes in Descending Order According to the 1957 Totals

MAKE	Per Cent of Total				
	January 1957	December 1956	January 1956	January 1957	January 1956
Ford	110,454	138,357	85,775	25.27	19.67
Chevrolet	101,116	129,111	100,342	23.12	25.33
Plymouth	41,262	43,649	38,945	9.44	8.56
Buick	35,013	40,105	44,803	8.01	10.30
Oldsmobile	31,787	34,720	38,825	7.27	8.46
Pontiac	24,015	27,960	26,721	5.40	6.85
Mercury	19,215	20,635	19,700	4.38	4.96
Dodge	19,442	19,665	15,501	4.22	3.59
Cadillac	11,800	11,896	11,472	2.70	2.88
Chrysler	10,439	10,055	9,096	2.39	2.11
De Soto	8,462	9,327	7,496	1.93	1.74
Rambler	5,210	5,573	4,626	1.19	1.07
Studebaker	5,051	5,707	7,000	1.15	1.62
Lincoln	3,076	3,235	2,942	.70	.68
Nash	1,192	1,583	2,197	.27	.51
Metropolitan	585	830	313	.13	.23
Hudson	512	753	974	.12	.07
Packard	363	690	2,833	.08	.66
Continental	67	149	210	.02	.05
Miscellaneous Domestic	271	165	104	.06	.02
Foreign	8,979	10,126	5,073	2.05	1.16
Total—All Makes	437,320	514,061	431,848	100.00	100.00

* Based on data from R. L. Polk & Co.

AND AVIATION INDUSTRIES

Chrysler Postwar Expansion Costs Hit \$1.3 Billion Mark

Topped by a record \$281.3 million expansion program last year, Chrysler Corp. capital expenditures since the end of World War II have exceeded \$1.3 billion. Last year's record outlay went for equipment, special tools, and plant expansion to increase the company's engineering division facilities by 36 per cent. Other facilities added during 1956 were a new automatic transmission plant at Kokomo, Ind., and an addition to the aluminum piston foundry in Highland Park, Mich.

Three major projects are included in the 1957 expansion plans. They are completion of the large Twinsburg, O., stamping plant; conversion of the Newark, Del., tank plant into an automobile assembly facility; and installation of new engine manufacturing facilities at the existing Trenton, Mich., plant.

Ford To Add Second Shifts At Louisville, Kansas City

Indication of the continued high rate of production by Ford is the announcement that two additional assembly plants will be put on double-shift operations. A second passenger car shift will be added at the Louisville plant in May. The Kansas City facility will go to a second shift the following month.

As a result, combined employment at the two plants will be increased by approximately 2500 persons. When in full operation, the two plants will add more than 500 cars to Ford's daily output. Ford currently operates three other plants on a two-shift basis.

Associated Spring Broadening Research & Development Work

A greatly expanded research and development program has been launched by Associated Spring Corp. Aim is to improve its present products — precision mechanical springs and spring steel — and develop new products.

As part of the expanded program, a new research center is being established at Associated Spring's head-



CZECH WHIRLYBIRD SOARS UPWARD ON TEST FLIGHT

The Czech HC2 experimental helicopter is powered by a 75-hp engine to give a maximum speed of 80 mph and a 13,000-ft ceiling. It was designed and built at the Aviation Research Center at Letnany, near Prague, for possible future applications.

quarters in Bristol, Conn. It will be completely equipped with testing and analytical devices required for fundamental research in mechanical and metallurgical engineering.

The staff of the new center in Bristol will gradually take over the research activities which in the past have been carried out on a decentralized basis at the twelve manufacturing divisions of Associated Spring. These are located in the principal industrial centers of the U. S. from coast to coast and in Canada.

Industry Pioneer P. M. Heldt, Former A.I. Editor, Succumbs

The death of Peter Martin Heldt, 82, retired Engineering Editor of AUTOMOTIVE INDUSTRIES (1916-1943) in Miami, Florida, on March 11, marked in many ways the end of an epoch. There probably no longer lives a single individual who for so many years was associated with the automobile industry in such a variety of roles as engineer, designer, consultant,

(Turn page, please)

TRUCK SALES OFF NEARLY 10,000 UNITS FROM YEAR AGO 1957 New Truck Registrations

Arranged by Makes in Descending Order According to the 1957 Totals

MAKE	Per Cent of Total				
	January 1957	December 1956	January 1956	January 1957	January 1956
Chevrolet	20,820	22,031	22,286	26.55	33.70
Ford	13,296	17,990	19,044	23.33	28.60
International	7,539	7,842	8,108	13.23	12.26
G. M. C.	5,175	6,011	6,072	9.08	10.39
Dodge	3,881	4,932	4,140	6.81	6.26
Willis Truck	1,357	1,732	861	2.40	1.30
Mack	1,016	1,101	959	1.78	1.45
White	1,015	979	1,251	1.78	1.89
Studebaker	987	902	849	1.22	1.28
Willis Jeep	506	950	450	.89	.68
Diamond T.	308	333	318	.54	.45
Roe	238	189	218	.42	.33
Divee	203	166	203	.36	.31
Kenworth	61	62	108	.11	.16
Brockway	51	64	75	.09	.11
F. W. D.	51	68	41	.08	.08
Peterbilt	45	38	38	.06	.06
Miscellaneous Domestic	116	86	95	.20	.14
Foreign	594	622	225	1.04	.34
Total—All Makes	56,979	65,696	66,141	100.00	100.00

* Based on data from R. L. Polk & Co.

News of the AUTOMOTIVE

and author of many technical works.

P. M. Heldt came to the U. S. from his native Germany in 1890 and joined the Roth Co. of Chicago, manufacturer of generators and motors, in 1895. Three years later, he became associated with the Munson Co. of Laporte, Ind., and was instrumental in the development of a gasoline-electric automobile.

His entry into the field of technical journalism actually began in 1900, when he joined the staff of *The Horseless Age* as an Associate Editor. This publication in 1917 was merged with

The Automobile, which later was renamed **AUTOMOTIVE INDUSTRIES**. Thus, his service with the present Chilton Co. and its predecessors covers a span of 43 years from 1900 to 1943.

An article by Mr. Heldt appeared in *The Horseless Age* in 1902 suggesting the formation of an association of automotive engineers. This proposal led directly to the organization of the present Society of Automotive Engineers. The Society took due recognition of his role in its founding when it presented a testimonial plaque to



Peter Martin Heldt

him at its Golden Anniversary celebration in 1955.

In addition to his editorial work and frequent consultations with industry authorities, Mr. Heldt was a prolific writer of articles and books on automotive subjects. Shortly after his retirement, Mr. Heldt revised a number of his earlier volumes. These are now offered for sale by the Book Div. of the Chilton Co.

Four-Barrel Carburetor Option Boosts Output of Rambler V-8

Revised AMA specifications indicate that a four-barrel carburetor option now is available on the Rambler V-8. In addition, the Warner Gear automatic transmission — Flash-O-Matic — is now in production for the Rambler Six. It replaces the Dual-Range Hydra-Matic, which was offered at the start of production on this model.

The four-barrel Carter carburetor boosts output of the 250 cu in. Rambler V-8 engine to 203 bhp at 4900 rpm. Torque is increased to 253 lb ft at 2500 rpm.

Divco Borrows \$3 Million To Boost Working Capital

Divco-Wayne Corp. has made arrangements to borrow \$3 million from the Prudential Insurance Co. of America. The loan, to be repaid over a 13-year period, will be used to increase the company's working capital and to finance consolidation of facilities.

1957 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	For Weeks Ending			Total: Jan. 1 to—	
	Mar. 16	Mar. 9	Mar. 2	Mar. 16, 1957	Mar. 17, 1956
PASSENGER CAR PRODUCTION					
Hudson	62	49	53	579	2,947
Nash	133	126	126	1,391	7,562
Rambler	2,170	2,175	2,110	16,017	26,816
Total—American Motors	2,365	2,350	2,289	19,967	37,325
Chrysler	3,082	2,974	4,086*	33,911	30,719
De Soto	2,965	3,076	3,553	37,708	28,127
Dodge	7,144	7,079	6,666	70,314	47,225
Imperial	1,159	1,010	5	9,855	*
Plymouth	14,781	15,619	14,713	161,486	111,634
Total—Chrysler Corp.	29,151	29,758	29,020	313,276	217,705
Ford	33,404	34,353	33,878	361,880	306,288
Lincoln and Continental	1,067	1,137	1,115	12,818	13,144
Mercury	8,607	8,540	7,647	66,723	54,551
Total—Ford Motor Company	43,078	44,030	42,640	461,421	373,983
Buick	10,912	10,146	10,749	122,639	105,311
Cadillac	3,375	3,366	3,503	35,962	36,525
Chevrolet	29,907	30,461	30,259	343,156	394,243
Oldsmobile	11,030	9,741	11,288	111,890	129,820
Pontiac	9,442	8,613	8,932	97,686	96,433
Total—General Motors Corp.	64,666	62,327	64,731	711,313	824,032
Packard	294	288	301	4,438	5,516
Studebaker	1,476	1,407	1,376	12,677	27,652
Total—Studebaker-Packard Corp.	1,770	1,695	1,679	17,115	33,368
Checker Cab	124	116	0	831	252
Total—Passenger Cars	141,154	140,276	140,359	1,523,943	1,486,685
TRUCK PRODUCTION					
Available	3	4	6	50	63
Chevrolet	7,085	7,720	7,334	79,523	91,357
G. M. C.	1,406	1,170	1,878	16,486	22,809
Diamond T.	78	75	86	860	1,050
Divco	80	80	80	845	1,007
Dodge and Fargo	1,702	1,789	1,735	19,032	18,436
Ford	6,336	6,289	7,026	66,408	70,277
F. W. D.	26	26	24	281	643
International	1,534	1,591	813	18,599	32,602
Mack	355	344	343	3,947	4,127
Reo	69	72	71	712	789
Studebaker	261	211	237	2,800	3,014
White	356	354	340	3,846	4,352
Willys	1,480	0	1,607	14,560	14,354
Other Trucks	63	61	69	611	1,303
Total—Trucks	20,656	18,606	21,649	230,339	266,033
Buses	77	105	71	792	865
Total—Motor Vehicles	162,067	159,187	162,079	1,755,074	1,753,563

AND AVIATION INDUSTRIES



ATOMIC-CURED TIRE

First tire ever vulcanized by nuclear radiation is checked by B. F. Goodrich scientists at the National Reactor Testing Station in Idaho. The tire encased in a steel mold, is slowly rotated over radioactive fuel elements in 17 ft of water to protect the scientists from radiation exposure. An ion chamber is used to determine the amount of radiation on floor.

Chevrolet Electronic Device Matches Proving Ground Tests

Chevrolet has developed an electronic device which it is using to determine how car and truck parts function independently in indoor tests. Called the "programmer," it can detect irregularities in engines, transmissions, and other parts much faster than any other method used so far.

The programmer controls a dynamometer which "drives" the part tested. The dynamometer is able to duplicate various conditions to which the part is ordinarily subjected in outdoor tests from information fed into the programmer, such as load, speed, and other variables.

Willys Export Business Up 4.3 Per Cent In 1956

Willys' overseas business continues to grow. Last year, the company shipped more trucks of 10,000 pounds GVW and under to other countries than any other maker.

The volume represented 35 per cent of the total industry shipments of trucks in that class. Value of all Willys shipments, including Jeeps, parts, and equipment, was placed at more than \$60 million. This was an increase of 4.3 per cent over 1955.

AAI TABLOID

Glen Alden Corp. and Maremont Automotive Products, Inc., have cancelled plans to combine operations of the two companies.

* * *

Aluminum Co. of America plans to spend about \$225 million for capital additions this year.

* * *

Westinghouse Electric Corp. will construct a new plant at Trafford, Pa., to manufacture switchgear apparatus.

* * *

Crane Carrier Corp. has bought Available Truck Co. . . Chromalloy Corp. has purchased Elyria Foundry Co.

* * *

B. F. Goodrich Co. recently dedicated a new tire manufacturing plant in Lima, Peru.

* * *

Reynolds Metals Co. plans to raise about \$150 million in new money. It will be used to finance construction of a new primary aluminum plant near the St. Lawrence Seaway project and to expand alumina, sheet and plate fabricating facilities.

* * *

Ross Gear and Tool Co., Inc., has acquired a one-third interest in Cam Gears, Ltd., of England.

* * *

Du Pont Co. has started construction of a new \$5 million research laboratory at Wilmington, Del., for its Pigments and Electro-chemicals Dept. . . Navy has broken ground for a \$38 million high-energy fuel plant at Muskogee, Okla.

* * *

Detroit Harvester Co. has purchased the Danville, Ill., plant of F. L. Jacobs Co.

* * *

Republic Steel Corp. and Fiat of Italy are planning construction of a \$120 million steel plant at Vado Ligure, near Genoa.

Electric Auto-Lite Co. reportedly will sell its Lockland, O., plant and other properties in Evendale, O., to General Electric Co.

* * *

Sun Oil Co. has disclosed that it is spending \$30 million to market its multi-grade gasoline blending system.

* * *

Socony Mobil Oil Co. will build a nuclear research center near Princeton, N. J.

* * *

Johns-Manville Corp. will spend a record \$37 million on plant expansion and improvement in 1957.

* * *

Bell Aircraft Corp. may be planning design of a new rocket-powered fighter plane.

* * *

Clearing Machine Corp. has moved its Cleveland office to new quarters in the Hanna Bldg. . . Arrow Tool and Reamer Co. has moved into new quarters at 711 Stephenson Highway, Troy, Mich.

* * *

Westinghouse Electric Corp., under contract with the Navy, is designing a nuclear propulsion plant for an atomic-powered submarine capable of carrying and firing guided missiles.

* * *

A. J. Sawyer Co. is name of new firm established in East Aurora, N. Y., to mold various types of plastic parts for the automotive and other industries.

* * *

B. F. Goodrich Co. has started testing new materials and parts for use in jet aircraft at a \$500,000 laboratory recently completed at its Los Angeles plant.

* * *

Curtiss-Wright Corp. has developed a mechanism to reverse the thrust of jet airplane engines and shorten the landing roll.

News of the AUTOMOTIVE

1957 RETAIL CAR SALES BY PRICE GROUPS*

Price Group	Number of Sales			
	1957		1956	
	Units †	% of Total	Units †	% of Total
Under \$2,000	13,963	3.26	75,405	17.88
\$2,001 to \$2,500	248,704	58.97	235,466	55.21
\$2,501 to \$3,500	124,399	29.05	95,987	22.51
Over \$3,500	41,212	9.62	19,014	4.40
Total	428,278	100.00	426,272	100.00

Dollar Volume of Sales*

Price Group	Dollar Volume of Sales			
	1957		1956	
	Dollars	% of Total	Dollars	% of Total
Under \$2,000	\$ 27,314,045	2.51	\$145,941,485	14.60
\$2,001 to \$2,500	539,886,198	49.62	504,235,260	50.45
\$2,501 to \$3,500	345,653,496	31.79	267,603,462	26.77
Over \$3,500	174,957,945	16.08	81,714,192	8.16
Total	\$1,088,012,483	100.00	\$999,494,399	100.00

*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four-door sedan or equivalent model. Does not include transportation charges or extra equipment.
†—New registrations of American made cars only. Does not include imported foreign cars.

Cars Only 52 in. High Viewed Possible in Span of 10 Years

If you think today's cars are about as low as they can get, guess again! Within 10 years, cars will be only 52 in. high, according to V. C. Raviolo, Ford executive engineer. Sliding roofs, tilting canopies, or "butterfly" doors may be necessary to get into them, he adds.

Other predictions for 10 years hence, predicted by Raviolo: 25 to 40 per cent more horsepower, a "hydrodynamic" torque converter with no gears except for reverse; windows mounted flush with the exterior for reduced noise and completely sealed for more efficient heating and cooling ventilation systems, ventilated seats, nearly doubled engine life, sealed transmissions and axles, and lifetime lubrication of chassis parts requiring no servicing except in case of failure.

Du Pont Financial Results In '56 Were Second Highest

Sales, earnings, and dividends of the Du Pont Co. in 1956 were the second highest in the company's history. They were exceeded only by the record highs established in 1955.

Sales were \$1,888 million, or one per cent lower than in 1955. Physical volume of sales, however, was about three per cent higher.

Reduction of selling prices of some products and increased costs resulted

in a lower profit margin. Net earnings from operations decreased 13 per cent from 1955 due to higher operating expenses and lower dollar sales, while average operating investment was seven per cent greater than in 1955.

Net earnings from operations as a percentage of operating investment declined from 13.8 per cent in 1955 to 11.3 per cent. Earnings for 1956 were \$8.20 per share of common stock, as compared with \$9.26 in 1955.

Stock Exchange Displays Show Growth Stories of Seven Firms

How investors have helped contribute to the growth of American business is told in displays at a new \$1 million exhibit hall and visitors gallery opened recently by the New York Stock Exchange at 20 Broad st., New York City. The center features exhibits of seven industrial concerns.

Among them is an exhibit by General Motors which depicts the role of investors, management, labor, research and engineering in industrial progress. Included is a symbolic factory and dealer's place of business, which illustrate the flow of manufactured goods and their sale.

In connection with opening of the center, GM observed that its number of shareholders has continued upward. The company had an all-time high of 667,308 shareholders of record Feb. 14.

Mobile Home Market Continues Boom and Demand for Materials

New York City played host for the first time early last month to the 20th annual National Mobile Homes Show. More than 250 models from 65 manufacturers covered three floors in the Coliseum, while displays of a 100 supplier exhibitors occupied a fourth.

Ranging from small vacation models to luxurious coaches 10 ft wide and more than 100 ft long, the units bore price tags from \$1000 to \$7500 and up. New features seen in the 1957 models included units which can be expanded to more than 12 ft, attachable aluminum cabanas, larger windows, and more luxurious interior appointments and equipment.

The mobile home industry has become big business with nearly 200 manufacturers and 3500 dealers; three millions persons living in mobile homes; and a total of more than one million units in use. A total of 121,470 mobile homes were sold in 1956 at a cost of \$501,185,220.

The fact that slightly more than one out of 10 housing starts last year was a mobile home means a sizable market for building materials and home furnishings producers. Aluminum Co. of America, for example, estimates that the mobile home market for aluminum alone is 50 million lb a year and that the aluminum in one large trailer averages 800 lb.

ASME Spring Meeting Includes Varied Program, Arsenal Tour

Rocket motors, engineering education, problems of improving industrial production, and other problems currently facing engineers will be discussed at the forthcoming spring meeting of the American Society of Mechanical Engineers. It will be held at Birmingham, Ala., on April 8, 9, and 10.

Technical sessions at the Dinkler Tutwiler Hotel will be preceded by a special two-day program for engineering students beginning April 5. More than 25 papers will be presented. The meeting will be followed by a tour of nearby Redstone Arsenal, a key U. S. missile development center.

AND AVIATION INDUSTRIES

Chrysler Gets U. S. Orders For Trucks, Spare Elements

Chrysler Corp. has received two separate defense contracts totaling nearly \$12 million. One, valued at \$8.3 million, is for production of 2900 four-wheel drive trucks expressly for export under the Government's defense aid program. The other contract is for \$3.5 million worth of spare parts for old World War II Dodge military vehicles supplied to other countries by the U. S.

Retarders Get More Study By Truck Manufacturers

Truck builders are giving retarders more serious studies. More truck drivers tend to remain in high gear on downgrades to avoid delaying traffic. Retarders are thus seen as the answer to making the operation safer.

Another important advantage is prolonged brake life. At least one company is planning to offer retarders on its 1958 truck line.

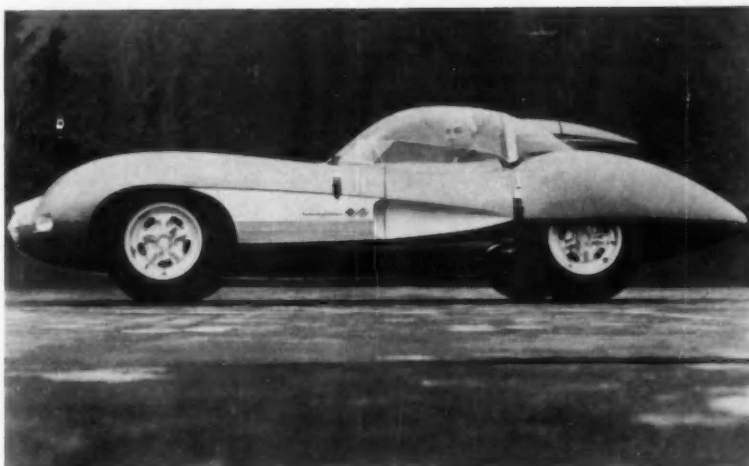
Rear-Axle-Mounted Transmission Being Studied by Car Producer

Next development in leveling off the floor hump in cars may be moving the transmission to the rear axle. To be effective, it would have to be attached to the differential and the combined unit affixed to the chassis to reduce unsprung weight and to eliminate up and down movement of the propeller shaft. Wheels would be sprung individually with swing axles to accommodate vertical wheel movement. At least one automobile manufacturer is giving the idea consideration.

Hi-Fi Tape Recorder Used In Mark II Noise Studies

Lincoln engineers are using a hi-fidelity tape recorder in sound and vibration studies of the Continental Mark II. Cars are tested at various speeds and on different road surfaces. The tape records all sounds, even the least audible ones.

Later, the tape is analyzed to determine how effective certain acoustic material is and where improvements could be made.



Chevrolet Corvette SS (Super Sport) experimental model car.

Advanced Design Ideas Are Voiced in Corvette

Chevrolet has wrapped up into one experimental model of its Corvette (see illustration) many design innovations that have been the subject of discussion among engineers for several years. It includes a tubular high-strength frame weighing only 180 lb, magnesium alloy body, independent wheel suspension all around, inboard rear brakes, DeDion type rear axle mounting, aluminum radiator, no-fan cooling, and separate brake systems for front and rear brakes controlled by a single pedal.

Developed under the supervision of Zora Arkus-Duntov, Chevrolet engineer and European designer, the Corvette SS (Super Sport) represents a research project in advanced engineering in the areas of performance, handling, braking, and other safety features, according to E. N. Cole, Chevrolet general manager. It will be tested over the most rugged race courses in the country to get, quickly, the comparative data that would take much longer to accumulate under normal research testing.

Wheelbase is 92 in., 10 in. shorter than the conventional Corvette, but overall length is the same. Use of light metals in the body, suspension, and many engine parts, plus other weight-saving devices such as a plastic fuel tank, cut total dry weight to 1850 lb,

950 lb lighter than the regular Corvette. As a result, power to weight ratio is 6.6 lb per hp.

The Corvette SS 300-hp-plus engine is a modified 283 cu in. production V-8. Deviations from standard include high performance camshaft; solid valve lifters; aluminum heads, clutch housing, and water pump; and magnesium oil pan. Unheated air for the fuel injection system is taken through the grille into a plenum chamber. Engine weight is 1.5 lb per hp.

The transmission is four-speed, synchronized, with aluminum alloy case, and weighs 65 lb. A short propeller shaft links it to the frame-mounted differential. A hydraulically-operated clutch release system is used in combination with a high-capacity coil spring clutch.

The aluminum radiator core has an engine oil cooler in the bottom tank. No radiator fan is used, the radiator and aluminum water pump being designed with capacities to meet engine cooling requirements. Engine and front brakes are cooled by air which enters through the grille and exhausts by ducts.

The welded tubular-truss frame of

Continued on Page 79

Men in the News



Michigan Tool Co.—H. Polphrey was named director of engineering research.



Studebaker - Packard Corp.—Sydney A. Skillman has been elected vice-president and general sales manager.

General Motors of Canada, Ltd.—Edwin H. Walker was elected president and general manager.

Du Pont Co. (United Kingdom), Ltd.—David H. Conklin has been appointed managing director.

Lee Rubber & Tire Corp.—Albert A. Garthwaite, Jr., has been elected president.

Reliance Electric and Engineering Co.—Richard A. Geuder has been named general manager of marketing, and Carl V. Gregory has become sales manager.

Lincoln Div., Ford Motor Co.—Earl F. Warner has been named production manager.

Standard Pressed Steel Co.—William I. Kryder and James V. Lester were appointed vice-presidents, and Charles A. Thomas was named assistant secretary.

Lindberg-Fisher Div., Lindberg Engineering Co.—H. E. Pollard is now chief engineer.

Westinghouse Electric Supply Co.—John F. Myers has been appointed general manager.

Olin Revere Metals Corp., Alumina Div.—John J. Miller has become general manager.

Electric Auto-Lite Co.—Richard D. Kelly was appointed director of equipment battery sales.

Warner Electric Brake & Clutch Co., Industrial Div.—Roger H. Brown has been named sales manager.



Wisconsin Motor Corp.—Ray J. Fellows, sales manager, and F. Burrows Esty, chief engineer, are now vice-presidents.

Timken-Detroit Axle Div., Rockwell Spring and Axle Co.—N. R. Brownier was appointed director of engineering.

Linear, Inc.—Gummar M. Oleson has been appointed controller.

Edsel Div., Ford Motor Co.—Gordon Marshall was made manager of the Organization and Systems Dept., and Robert K. Norton was chosen manager of the Sales and Profit Analysis Dept.

Press Automation Systems, Inc.—Thomas M. Ryan is now vice-president and general manager.

Tatnall Measuring Systems Co.—Bruce L. Sutton was named sales manager.

Clark Controller Co.—Harry M. Cook has been named manager of industry sales.

Thor Power Tool Co., Industrial Div.—William J. Laughlin was made manager.

Teer, Wickwire & Co.—Jack H. Marshall was named vice-president in charge of sales.

Westinghouse Electric Corp., Aviation Gas Turbine Div.—James D. Redding is now general manager of the Sales & Service Dept.

Goodyear Tire & Rubber Co., Shareholders Div.—Morris A. Dannenbring was named manager.

Oakite Products, Inc.—Charles F. Radley has retired as director of publicity and member of the board of directors.

Pesco Products Div., Borg-Warner Corp.—James R. Becker was promoted to assistant sales manager of aircraft pumps and accessories.

McKinnon Industries, Ltd.—E. Jack Barbeau was elected president and general manager.



Clearing Machine Corp.—John Michelotti has been named director of purchases.



National Automatic Tool Co.—S. J. Hunt was appointed vice-president in charge of engineering.

Vertol Aircraft Corp.—John C. Waugh was made manager of public relations.

Transue & Williams Steel Forging Corp.—Roy E. Hess is now New York district manager.

Necrology

Lee J. Eastman, 80, former president of the Packard Motor Car Co. of New York and a retired vice-president of the Packard Co. of Detroit, died Mar. 11, at Stamford, Conn.

George H. Moriarty, 62, a former president of Durant Motors, Inc., died Mar. 8, at Los Angeles, Calif.

William L. Neilson, vice-president and former director of Norton Co., died Mar. 5, at New York, N. Y.

Henry H. Gilbert, 66, manager of the testing laboratory of the Ford Motor Co. Engineering Staff, died March 5, at Clearwater, Fla.

A. J. Wieland, 61, general manager of the Ford International Div., died Mar. 21, at Detroit, Mich.

A. P. Warner, 86, automotive inventor and founder of Stewart-Warner Mfg. Co. and Warner Electric Brake & Clutch Co., died Mar. 22, at Beloit, Wis.



Automatic screw machine, producing pump parts, has used dual-purpose *Texaco Cleartex Oil B* most successfully as cutting oil and machine lubricant, for over seven years.

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THE RIGHT LUBRICANT can do a lot toward speeding production, increasing tool life. Take, for example, *Texaco Cleartex Oil*. It's a multi-purpose oil—cutting fluid and machine lubricant—with relatively high extreme pressure properties. Good stability and load carrying ability mean less wear on moving parts. And it's clear and transparent for faster, easier inspections.

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AUTOMOTIVE INDUSTRIES, April 1, 1957



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B&W ERW Mechanical Tubing, with smooth I.D., can be delivered to you ready to use in hydraulic systems. Where inside surface is of prime importance and no stock removal is planned prior to application, this tubing is made for the job because it is furnished with a smooth inside surface having a guaranteed maximum average micro-inch finish.

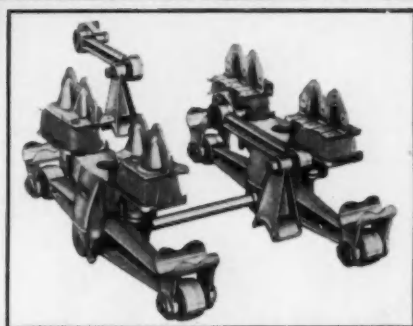
In addition to smooth inside finish, this B&W Tubing assures you of uniform wall thicknesses, plus uniform and close I.D. tolerances. It combines light weight and high strength. It means long life and better performance in fluid systems for heavy duty or automation applications.

For complete information on B&W ERW Mechanical Tubing with smooth I.D., or on any tubing problem, call for Mr. Tubes—your direct link with B&W. Write for Bulletin TB-419. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.



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The unique design of the "load cushion" accounts for smooth, even rides in the full range of loads, empty to full. Enjay Butyl Rubber (in red) made it possible.

ENJAY BUTYL "LOAD CUSHION"

replaces steel springs in big Tractor Trailers

The "load cushion" is an important innovation in tandem suspension. Developed by the Hendrickson Mfg. Company, it is made of Enjay Butyl and replaces steel leaf springs. Utilizing the great strength and impact resistance of Enjay Butyl, the "load cushion" gives the ultimate in a soft, easy ride within the complete range of loading, from empty to full. Besides giving a smoother, steadier ride, it increases tire mileage, reduces weight and significantly reduces wear and tear on equipment.

Enjay Butyl has proved to be the answer to problems in many fields of industry. It may well be able to cut costs and improve the performance of *your* product. Low-priced and immediately available, Enjay Butyl may be obtained in non-staining grades for white and light-colored applications. Get all the facts by contacting the Enjay Company. Complete laboratory facilities and technical assistance are at your service.




Enjay Butyl is the super-durable rubber with outstanding resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.



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So effective is the AiResearch turbocharger that it provides power gains while actually lowering the heat level of the engine.

Ambient air is compressed with an efficiency as high as 82%, feeding a maximum weight of air into the cylinders at the lowest possible temperature.

Results: maximum power gain at minimum fuel cost; complete combustion with elimination of objectionable smoking; low

engine thermal loading insuring long, trouble-free operation.

All AiResearch turbochargers are air cooled, placing no added burden on the diesel cooling system and requiring no complicated plumbing. The rotating assembly

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Your inquiries are invited.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	F-51	C-60	A-60	E-100	B-100
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min.	25-40	35-65	35-65	70-95	115-175
(Standard Conditions)					

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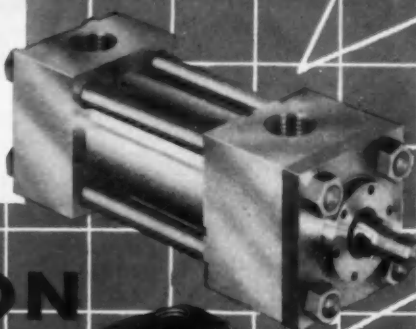
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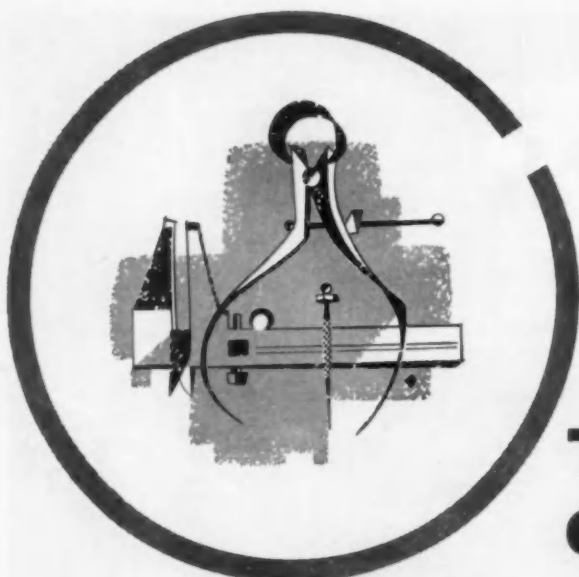
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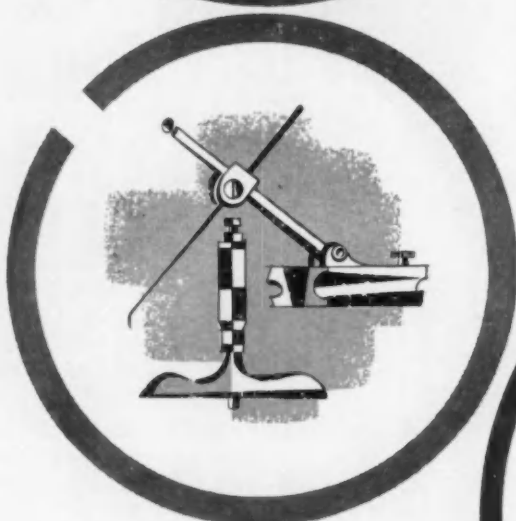
Consult an Ortman-Miller representative regarding your pneumatic and hydraulic problems. His broad experience with standard and special cylinder applications is available to you without cost or obligation. Use convenient coupon for name and address of O-M representative nearest you.





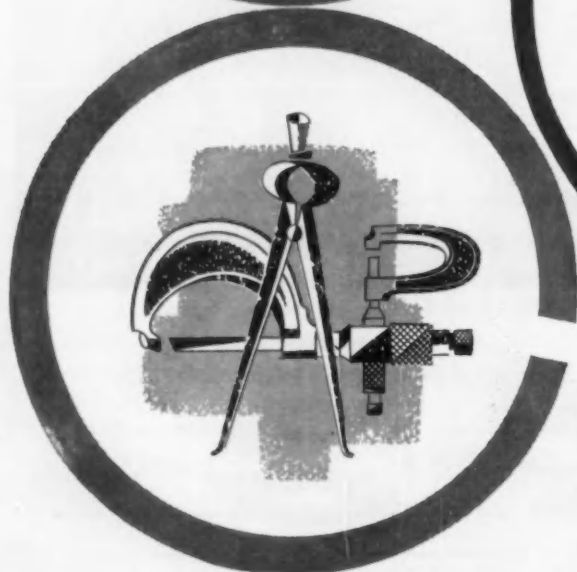
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HY-PRO specialists deliver savings as high as 98% with taps of special design

While HY-PRO standard taps meet most production needs, you can rely on HY-PRO specialists to tell you when it will pay you to use a tap of special design. You can also rely on the design they develop to deliver maximum savings, — in tap expense, in production time. The proof is in the records of hundreds of jobs like the two described below. Why not let HY-PRO engineering ability and experience uncover comparable savings for you?

from 300 to 18,000
holes per tap...



Friable plastic part for electronic industry. Previous tap life of 300 holes-per-tap boosted to an 18,000 rate with the use of a multi-fluted tap specially designed by HY-PRO specialists. Tap cost saving — 98% plus. HY-PRO pioneered development of taps for plastics, and has wide experience with all types of compositions that can be applied to your advantage.

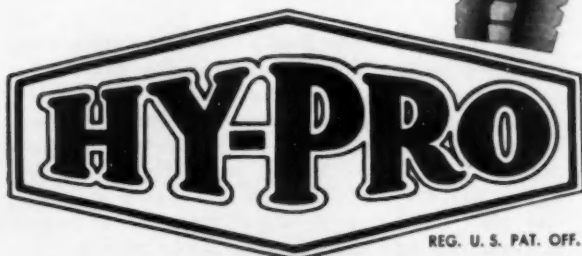
Tap Cost
SAVINGS
98%

from 100 to 800
holes per tap...



Tap Cost
SAVINGS
88%

Stainless steel aircraft part. HY-PRO tap of special design raised tap life from 100 holes-per-tap to 800. Threading with the original tap was rough, varying over tolerance. With the HY-PRO special, it is smooth, clean, consistently Class 3. Savings in tap cost — 88%; plus an additional big saving gained by eliminating rejects previously scrapped because of inaccurate threading.



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Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. It costs nothing to consult HY-PRO specialists, and they can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. What's your problem? Write: Dept. A.

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Car Suspension Era at Hand

New Designs in Springing for Passenger Cars; Rear Axle Improvements; Electrical System Progress, and Other Timely Engineering Developments Featured at SAE Meeting in Detroit

By James R. Custer

SUSPENSION design has definitely moved to the forefront as a major interest of automotive engineers. That was evident during the SAE National Passenger Car, Body and Materials Meeting held last month in Detroit. Of the eight technical sessions scheduled for the three-day meeting, the largest attendance took place at the new suspensions session.

For several years the automobile companies have been developing and testing various suspension designs. A change-over to ball-joint front suspension has been made in recent years. Another continuing trend, the adoption of different springing, began with the 1957 models. Air suspension was introduced on the Cadillac Eldorado Brougham by General Motors, which also has applied it to trucks and buses. Descriptions of the specific designs have been published in previous issues of *AUTOMOTIVE INDUSTRIES*.

Chrysler Corp. placed torsion bar suspension (Torsion-Aire) (see *AI* Nov. 1, 1956) on all of its 1957 cars—Plymouth, Dodge, De Soto, Chrysler and Imperial. The Chrysler design combines a torsion bar suspension system at the front with a modified Hotchkiss drive-leaf spring rear suspension. One basic front suspension unit is used on Plymouth and Dodge cars, another larger unit on De Soto, Chrysler, and Imperial lines. Valving in the front shock absorbers has been changed to provide greater shock resistance, thus permitting the elimination of the sway bar on Plymouths and on most Dodge models.

Development and production application of the Chrysler Torsion-Aire and General Motors air suspension were reported in two outstanding engineering papers. The Chrysler paper was prepared by O. D. Dillman and R. R. Love of the corporation's engineering division. V. D. Polhemus and L. J. Kehoe,

Jr., General Motors engineering staff, reviewed the development of the air spring. Its application in the Cadillac Eldorado Brougham new suspension system was described in a paper by F. H. Cowin and S. L. Milliken, Cadillac engineers.

Another session that attracted unusual attention was on rear axle design. An excellent paper was prepared by Robert P. Lewis, consultant, and Loren J. O'Brien, chief engineer-axle division, of the Dana Corp. In analyzing the various designs used in European and American cars, they predicted a trend to non-slip differentials and independent rear suspensions in this country. Bain Griffith, Ford Motor Co., reviewed the design and production problems resulting from the lower offset pinion now used in Ford and Mercury rear axles.

Rear-mounted engines continue to create much interest. Three interesting papers were given at a symposium. Fernand Picard, engineering and research manager of the French Renault company, analyzed the progress of the rear-mounted engine and showed by statistics of European production that it will continue to improve its market position for piston displacements under 91 cu in. Picard was unable to attend the meeting, so his paper was given by Henry L. Brownback, Renault technical consultant.

J. E. Witzky, Daimler-Benz of North America, read the paper on the Mercedes-Benz racing cars by H. Scherenberg, of Daimler-Benz Germany. He reported on the engineering development program that resulted in the selection of the naturally-aspirated 2.5 liter (152.56 cu in.) engine in preference to the supercharged 750 cc (45.77 cu in.) engine. In extensive tests the former delivered much better torque performance and considerably lower specific fuel consumption over the speed range.

Important engineering reports also highlighted the other sessions on progress in electrical equipment, new automotive finishes and plastic materials, and on vacuum-melted metals. Extracts from as many papers as space permits are given here.

Chrysler Torsion-Aire Suspension

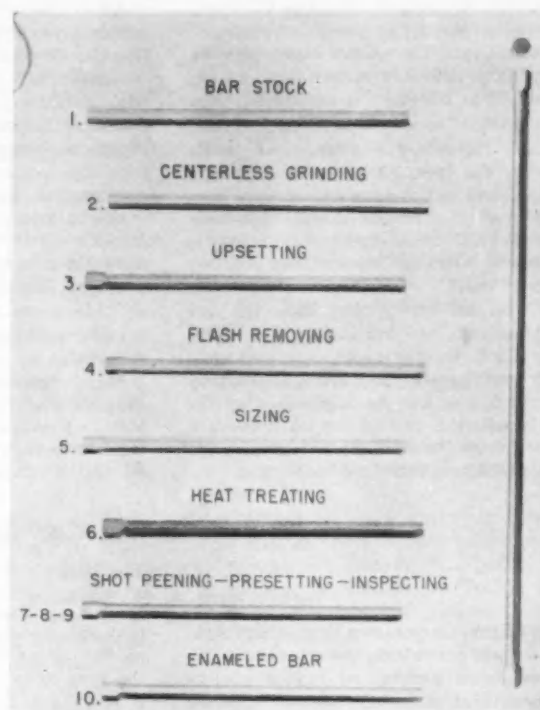
BY O. D. DILLMAN AND R. R. LOVE
Engineering Div., Chrysler Corp.

THE main feature of the Chrysler Corporation's front suspension is, of course, the use of torsion bars. The torsion bar is the most efficient way to use expensive spring steel that we know. As a comparison, a 1956 production coil spring weighed 15.8 lb as compared to 10 lb for a torsion bar. The major saving is in the elimination of dead coils for seating.

The rear of the torsion bar is fixed in an anchor housing that is cradled in the engine rear frame cross member. The adjustable height feature of the torsion bars allows us to insure that all front end car heights are uniform as the cars come off the assembly line, and permit further field adjustment, if necessary.

In addition to the above reasons, torsion bars permit us to more exactly transfer the loading point of the suspension to the portion of the frame structure which can best handle these loads. By eliminating the previously-used bulky coil springs, the torsion bar also gave us more usable space in the engine compartment—a major consideration with today's low car silhouettes.

Fig. 1 — Chrysler front suspension torsion bar manufacturing steps



The major factor in the design of high-production torsion bars is to keep operating stresses down and thus permit normal automotive production

methods. Figure 1 shows each of the 10 steps that a piece of bar stock goes through in becoming a Torsion-Aire torsion bar.

Cadillac's Air Suspension for Eldorado Brougham

BY F. W. CORVIN AND S. L. MILLIKEN
Cadillac Motor Car Div., General Motors

THE general arrangement of the air suspension components is shown in Fig. 1. The compressor is at A; The air reservoir is shown at B; The control solenoid package is shown at C, positioned between the air reservoir and the leveling valves; The three wheel leveling valves are shown at D; The air springs are shown at E on the diagram.

All of the air lines are 3/16 in. OD copper tubing. This diameter of pipe was found to be the smallest that would allow the fast leveling we want when a car door is opened. Further experience and testing may allow us to use less expensive steel or plastic lines.

The design and location of the components were developed with constant consideration of the making and the ultimate assembly of the parts into the chassis. As a result, the air spring suspension has caused no unusual problems on the production line.

The vital importance of a leak-free

system was realized from the first consideration of the idea, so the design, the manufacture and the assembly of the components has been tailored to that result. The air domes and the front piston are checked for

air leaks at 150 psi, under water.

The sub-assembly of air dome, piston, piston skirt and diaphragm is tested at 90 psi with a mixture of 4 per cent Freon in clean air. A sniffer (the General Electric leak detector)

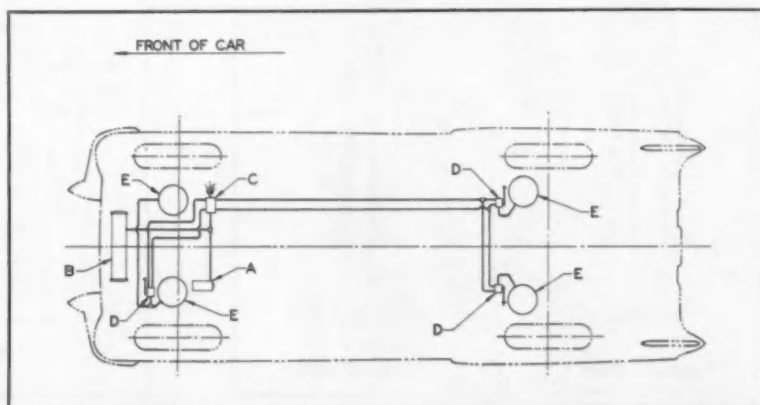


Diagram of air suspension system on Cadillac 1957 Eldorado Brougham

is used to check for leaks, in the same manner as for air-conditioned car installations. The piston is actuated at varying rate and stroke during this test. The air dome is exhausted, then recharged to 4 psi with pure Freon gas. Repeat checks are then made with the leak detector. Clamps are attached to the assembly to hold it to normal car height during handling and until it is assembled into the chassis. The air dome is then charged to 60 psi.

The air-line fitting into the air dome has a Schraeder-type valve which holds the pressure in the dome. When the air lines are connected to the domes at the assembly in the chassis, the end of the air-line tube depresses the Schraeder-type valve for a quick and leak-free connection.

Mercedes-Benz Racing Car Design

BY H. SCHERENBERG

Daimler-Benz A. G. Germany

WITH an unblown engine the highest possible degree of cylinder filling is of paramount importance, so particular design attention must be paid to valve timing and cross-section areas. To get a maximum of cross-section areas, we found a new valve gear arrangement. With this it became possible to arrive at generous valve openings, which never could be obtained with a normal valve gear arrangement.

Figure 1 is a basic layout sketch showing the difference between normal and controlled (desmodromic) valve actuation. The left-hand portion illustrates a usual layout with cam, valve, valve-spring and cotter. In this arrangement the valve is opened by the cam, while the valve-spring is compressed at the same time. On closing,

After the complete assembly of springs, pipes and controls into the chassis, there is another sniffer test for leaks, and there is a final check with soapy water on the tubing connections. Experience gained with air-conditioner installations has helped with the air suspension as the leak problems are similar.

The suspension system was subjected to an extensive testing program after the final design was determined. Tests at Pikes Peak and other high-altitude areas showed that the compressor had adequate capacity for the suspension at any operating altitude.

Many thousands of miles on the Belgian block roads at the General Motors Proving Grounds and on road tests have shown satisfactory life for all of the components.

that means, when the cam has moved on, the spring closes the valve against the cam. The strength of the spring is therefore the deciding factor for the closing operation.

The desmodromic valve gear has two cams per valve. One cam is directly above the valve and is responsible for the valve opening; the other closes it via rocker-arm.

The desmodromic valve gear enabled acceleration values to be obtained, the extent of which had never been known until then. Figure 2 gives direct comparison values of a racing engine with spring-operated valves, calculated on the basis of today's experience, and the new desmodromic actuation.

The acceleration curves show that higher rates of acceleration and considerably increased rates of deceleration

are possible with the new system, and this enables the angle of opening to be kept relatively small, and therefore comes close to the ideal situation.

Further increases permit engine development to even higher speed ranges without hindrance by valve gear limits. How the drivers liked the willingness of their engines to speed-up, could be clearly seen after the various races, when the maximum tachometer needle reading was checked. The one in Fangio's car usually showed over 9000 rpm.

New Look at Generator Capabilities

BY P. W. HOUSE

Assistant Chief Engineer

Delco-Remy Div., General Motors

IT has long been the practice to evaluate automotive generators in terms of rated output, minimum mph for full output, minimum mph to carry the load, cut-in speed, and various other values. Each of these is a measure of only one of the characteristics affecting the generator's ability to perform its function.

With recent sharp increases in the use of continuous duty accessories, such as air-conditioning and power controls, the need for a new rating, which takes into consideration the combined effect of all of these individual characteristics, becomes apparent. In essence, the adequacy of a generator is measured by its ability to keep the battery charged. A generator's ability to meet this requirement can be evaluated by two individual characteristics:

1. Its rated output.
2. Its city load carrying capacity, i.e., its ability to carry the car's

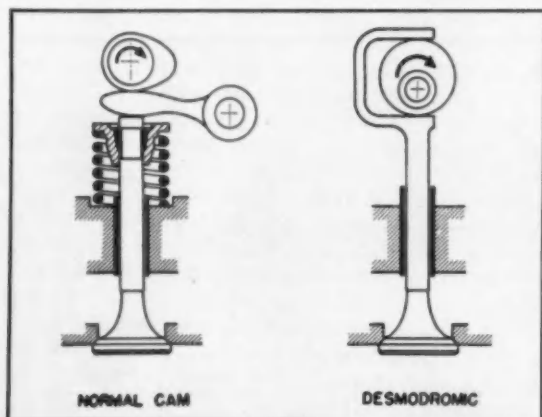


Fig. 1—Diagram of conventional cam and desmodromic valve actuation

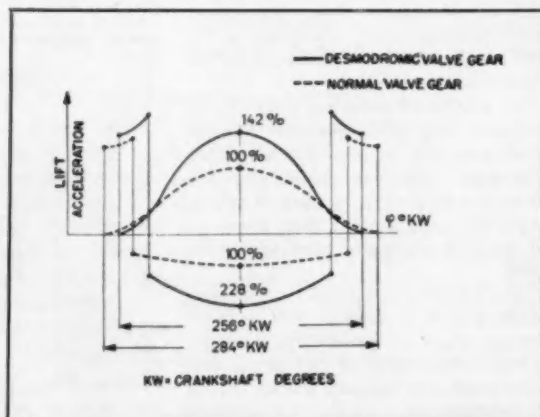


Fig. 2—Comparison of lift and acceleration curves

electrical load in low-speed city driving conditions.

The city load carrying capacity necessary for an automotive application depends on the electrical loads encountered in city driving. The load is not constant, of course. At night it may vary from a total night load consisting of headlights (lower beam), air-conditioner or heater-defroster, radio, ignition, and continuous duty accessories, to a minimum night load consisting of lights and ignition only. The daytime load may range from the

total possible load, exclusive of lights, to a minimum load consisting of ignition only. The city load carrying capacity obviously must fall somewhere within this extreme range of loads varying from the total night city load to the minimum daytime load of ignition only.

A survey of rundown battery complaints on various applications in recent years indicates that the city load carrying capacity should fall between the total night load and the total daytime load.

Tomorrow's Rear Axles

BY ROBERT P. LEWIS, Consultant to Vice Pres.-Eng.
AND LOREN J. O'BRIEN, Chief Engineer, Axle Div.

Dana Corp.

LOCKING DIFFERENTIALS—A conventional differential as used in today's passenger cars and trucks offers definite limitations to performance under a variety of driving conditions. As the performance characteristics of cars and trucks improve with larger engines, etc., owners will become more dissatisfied with the lack of performance under these adverse conditions. We can therefore expect that it will be necessary to provide some form of limited slip differential to overcome these objections. The fact that the conventional differential has disadvantages is evident by the efforts that have been extended to overcome its limitations. There are over 300 patents of devices to improve the conventional differential.

In the past eight or ten years we have had an extensive program to obtain a differential which would overcome the limitations of the conventional differential and yet provide a unit which could be used satisfactorily in today's vehicles at a reasonable cost. We made a careful study of all types, including full locking, bias or power dividing, over-running, hydraulic, etc. This covered all methods of construction, variable leverage, bastard teeth, eccentric pinions, cranks, shoe and band brakes, cams and sliding pins, spirals, cross-helical, and worm gears, over-running clutches, ball, roller, and sprag escapement clutches, also both hydrostatic and hydrodynamic arrangements.

This work established a number of requirements for a good locking differential. These were that No. 1—it must maintain differential action. No. 2—it must prevent shock loads, and the transfer of full engine torque to one axle shaft, so must not be of the full locking type. No. 3—it must provide sufficient traction torque to the non-

spinning wheel at all times and under all operating conditions. No. 4—it must not interfere with steering. No. 5—it must be of long life and not subject to abnormal loads of wear. No. 6—it must continue to function efficiently, regardless of the amount of wear. No. 7—it must be quiet in operation. No. 8—it must be of minimum cost, size, and weight. No. 9—it must be a unit that could be used without major design changes in today's axles.

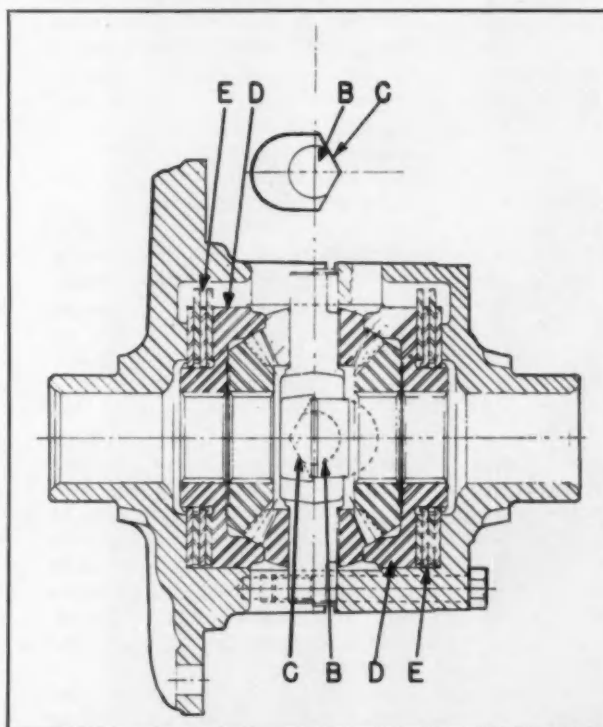
During this period of development we tested approximately 25 devices of different design and construction.

Many of these were of our own design and others were submitted to us by outside sources. Some were already being used and some were from foreign sources. We found that the Thornton Powr-Lok differential fulfilled all of our requirements and in addition, had two or more additional worthwhile features. No. 1—in the Thornton Powr-Lok the capacity is increased over conventional differentials as the load is divided between the gear teeth and the clutches. No. 2—action in the Thornton differential is the same for both drive and coast loads and forward and reverse driving. We therefore decided upon the Thornton Powr-Lok design as being a practical unit and for the past few years have been working on the problems connected with the production of this unit.

Figure 1 shows a Thornton Powr-Lok unit as we are now building it in production. A brief description of the action of this unit might be in order. The torque is transmitted from the differential case to the cross pins and differential pinions to the side gears in the same manner as torque is applied in the conventional differential. The driving force moves cross pins B up to the ramp of the cam surface, C, applying a load to the clutch rings, D, and restricts turning of the differential through the friction surfaces of the clutches at E. This

(Turn to page 94, please)

FIG. 1
Powr-Lok
differential



New Semi-Automatic Truck Transmission

THE new StepMatic developed by the Transmission Division of Clark Equipment Co., is a semi-automatic transmission which minimizes use of the gearshift lever and clutch pedal. Designed for use in highway trucks, this heavy-duty unit is an integrated combination of a five-speed synchronized transmission and an auxiliary gear train.

Design and Operation

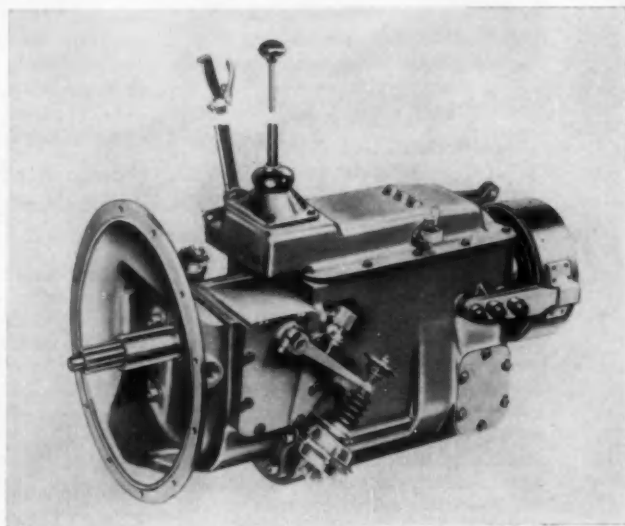
The auxiliary unit is composed of a direct and an underdrive gear set which are semi-automatically engaged. The underdrive gear ratio "splits" the geared steps of the transmission. As a result, the StepMatic has 10 closely spaced gear ratios.

Regardless of the transmission gear in use, the truck driver can obtain additional gear reduction immediately by "floorboarding" the accelerator pedal, or by pushing a button on the dashboard, or shift lever, as arranged to suit the truck builder's option. This shifts the auxiliary into underdrive and provides additional gear reduction. The auxiliary automatically returns to direct driven when the driver relaxes the accelerator pedal. The 10-speed unit is currently available in two sizes, Model 303X rated for engine torque output of 300 lb-ft, and approximately $5\frac{3}{4}$ in. longer than conventional five-speed transmission; and the 400-X, rated for 425 lb-ft torque and $6\frac{7}{16}$ in. longer than conventional five-speed units.

The engagement of the underdrive ratio in the StepMatic transmission is controlled by a speed responsive governor and by a kickdown switch. A right-angle helical gear on the governor shaft is driven by a drive gear mounted on the StepMatic input shaft. The kickdown switch, which completes or breaks the circuit actuating the shifting mechanism, can be mounted on the dashboard, underneath the accelerator pedal or on the main transmission shift lever.

At engine speeds at or below idling speed, the StepMatic unit is always underdrive. At increased engine speed, the governor makes contact to complete a solenoid valve circuit. Air or vacuum then actuates a cylinder which compresses a spring to produce force on the auxiliary shift lever. This tends to shift the unit into direct gear. However, the shift to direct does not occur until the operator relaxes the accelerator pedal. This produces the torque reversal which allows the clutching gear to shift into direct.

When engine rpm returns to idling speed, the governor breaks contact, thus breaking the solenoid



The new StepMatic transmission

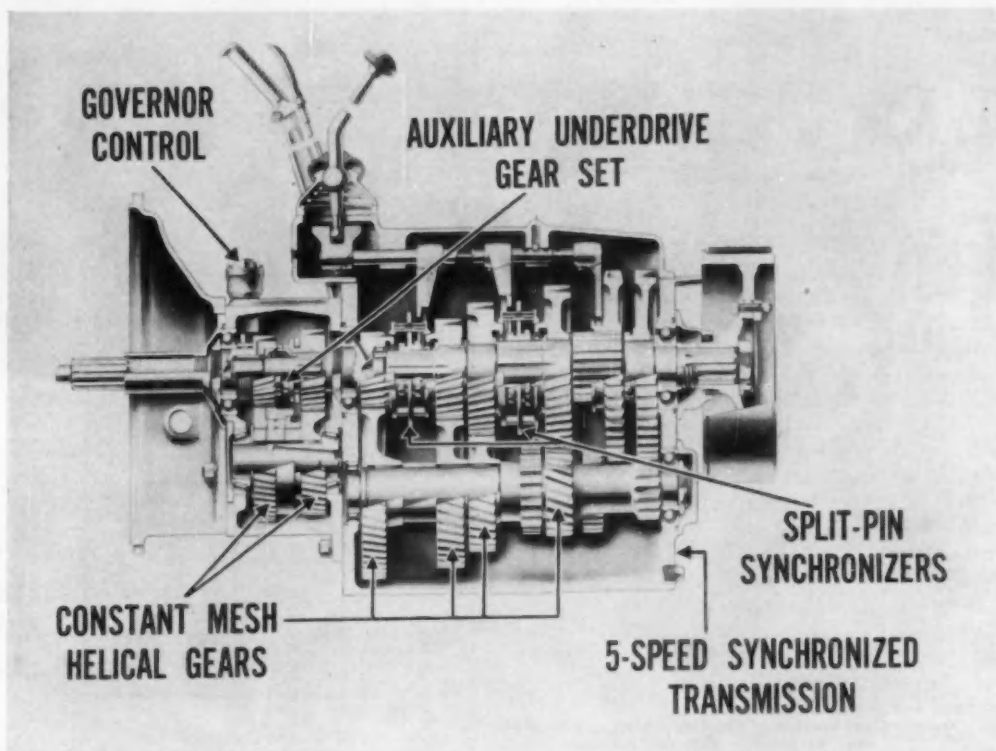
valve circuit. The return spring in the cylinder, aided by thrust from the helical sliding gear, tends to automatically shift the StepMatic unit into underdrive. This takes place when load on the clutch teeth is reduced, as in normal deceleration.

The controlling action of the governor on the StepMatic unit takes place within the idling speed range. At high speeds, the StepMatic unit is controlled by the kickdown switch.

When operating conditions require added gear reduction, the truck driver actuates the kickdown switch. This breaks the circuit on the solenoid valve and the return spring in the cylinder tends to shift the unit into underdrive. This cannot be completed until torque reversal takes place. Instantaneous torque reversal is accomplished by momentarily cutting off the engine fuel supply through action of the kickdown switch.

Upon completion of the shift, a remake switch instantaneously restores the fuel supply. Also, the StepMatic preloads itself for the shift into direct, but remains in underdrive until the operator relaxes the accelerator.

A reverse lockout switch is provided to prevent any upshift to direct while in reverse gear. When the main transmission case has shifted into reverse gear, a ramp on the reverse rail pushes the plunger in the switch and breaks the governor circuit.



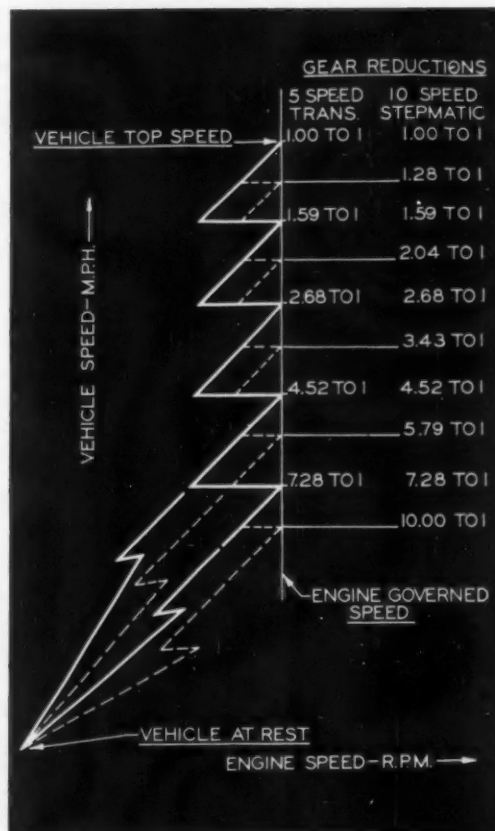
Sectioned view of the transmission assembly

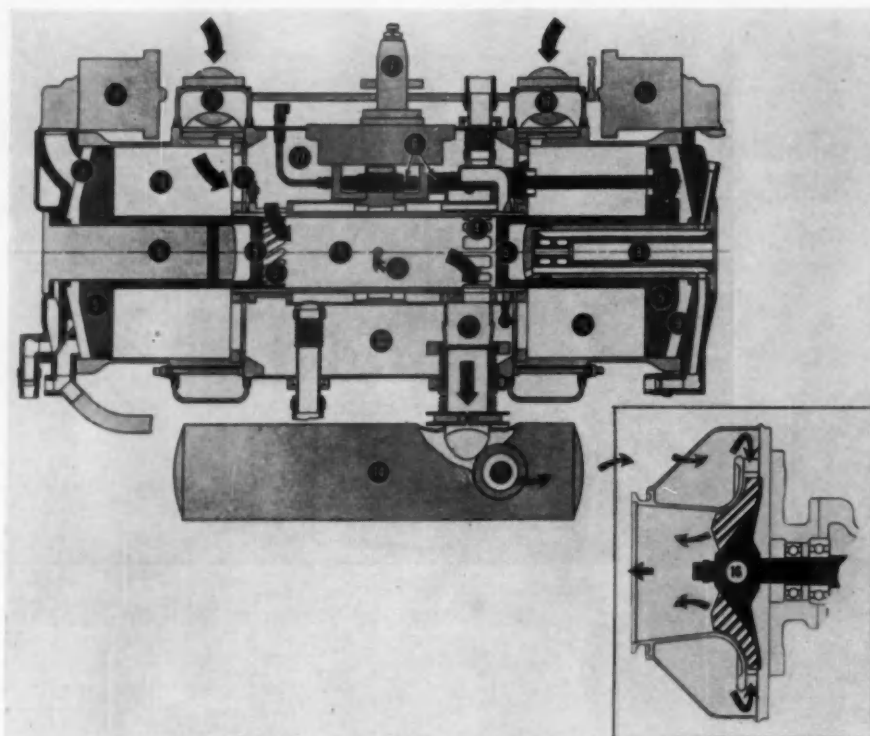
With the StepMatic, a truck can usually be started in second, even under severe operating conditions. This avoids the normal difficulty of shifting out of low into second and the resulting loss in vehicle speed. Starting with the StepMatic in second, the additional ratio of the auxiliary is automatically added to the second gear ratio. After starting, the shift to conventional second is made quickly by relaxing the throttle.

Gear and mainshaft are of carburized alloy steel. To obtain maximum properties of steel, fine grain, full upset and heat treated forgings are used.

The auxiliary unit uses conventional helical gears of the counter-shaft arrangement. The clutch housing is available in SAE Nos. 2 and 3 for Model 303X and SAE Nos. 1 & 2 for the 400X model, and the clutch shaft end is a standard spline to accommodate most conventional clutches. The main shaft end is 1½ in. diameter for the 303X and 1¼ in. diameter for the 400X of standard 10 spline for both models. Controls can be furnished for center, forward, or for remote operation. The rear bearing cover is arranged for standard type speedometer gears.

The transmission brake is cam-operated and can be adapted for actuation from either side of the transmission. The brake band is 10½ in. diameter by 3 in. wide for 303X and 11½ in. diameter by 3½ in. wide for the 400X model.





Longitudinal section of the free piston engine showing the gasifier and the turbine

CONDENSED ENGINE SPECIFICATIONS

Type:	Free piston gas generator-turbine, two-stroke Diesel cycle
Number of Engine Cylinders:	One, with two horizontally opposed free pistons
Engine Cylinder Dimensions:	
Bore.....	3.75 in.
Effective Engine Stroke.....	4.2 in.
Mechanical compression ratio.....	15 to 1
Gas temperatures:	
At time of ignition.....	1000 F max.
At turbine inlet.....	940-960 F max.
At turbine exhaust.....	750 F max.
Pressures:	
Air box at intake ports.....	22-40 psi
Surge tank.....	16-27 psi
At turbine.....	15-25 psi
Ratio, turbine revolutions to rear wheel revolutions (in first gear),	5600 to 1
Starting cycle:	Create vacuum in bounce cylinder to pull pistons apart; push prime button; release compressed air to bounce cylinders.

EXPERIMENTAL TRACTOR

THE experimental Typhoon tractor, revealed by Ford Motor Company's Tractor and Implement Division, is the first vehicle of its type to be powered by a free piston turbine engine.

The Typhoon maintains a "family" resemblance to Ford tractors now in production although it is larger overall than current models. A large intake scoop on top of the hood supplies air to the power plant. Two teardrop-shaped stacks extend through the top of the engine hood and direct the exhaust gases into the air.

Although the power plant is capable of producing 100 hp, the experimental Typhoon utilizes only about half of this potential. According to Ford engineers, several



The experimental Typhoon tractor

CONDENSED TRACTOR SPECIFICATIONS

Type:	Dual Front Wheel Row Crop
Dimensions:	
Overall Length	144 in.
Overall Height	70 in.
Wheelbase	89 in.
Transmission:	Power-shift; ten speeds forward, two speeds reverse
Power take-off:	Independent
Rear tire size:	13 by 30
Front tire size:	9.50 by 16
Drawbar horsepower:	50 (approx.)
Instruments:	Gasifier cycles/minute, turbine revolutions/minute, turbine inlet pressure, fuel pressure, water and oil inlet temperatures, indicator lights for lubrication, battery charge, cooling oil pressure.
Engine Accessories (driven by turbine):	Radiator cooling fan, water pump, generator, oil pumps (cooling, lubricating and hydraulic systems), fuel pump, tachometer.

Has Free Piston Engine

advantages of the engine already are apparent, however. Fuel economy already appears promising. Engine friction is substantially lessened by the reduction of moving parts. Vibration is virtually eliminated by the inherent balance of the engine.

Instruments are located in a panel directly in front of the steering wheel. There are several new temperature, pressure and tachometer gages not found on conventional tractors. A throttle control lever and a gear selector lever are located on opposite sides of the hood, close to the steering wheel.

Power from the turbine is transmitted through a 10-speed forward, two reverse, power shift transmission—also experimental. Gear speeds are changed with the selector lever. Power shifts into or through all gear ratios can be made without stopping, manual clutching, or interrupting the power flow. Feathering is provided for attaching implements or slowly starting a load in any pre-selected gear. A "park" position, indicated on the selector, locks the tractor wheels by applying internal transmission brakes.

The free piston turbine engine which powers the Typhoon experimental tractor is shown here in cross section. The gasifier is a two stroke engine, having a compression stroke and a power stroke. Insert shows the turbine (not drawn to scale).

The combustion cylinder (1) with fuel injector nozzle (2) is water cooled along its length. Intake ports are at (3) and exhaust ports are at (4). Two "free" pistons (5) are linked together mechanically by a rack and pinion arrangement (6) so that they move inward and outward the same distance and at the same time. The fuel injector pump (7) is driven by a cam on one of the racks. The pistons slide on fixed supports (8) and are oil cooled and lubricated as they move. In the position shown, the pistons have compressed the air in the "bounce" cylinders (9). This air acting as a spring will force the pistons toward the middle of the combustion cylinder.

During the compression stroke, air is pushed from the compression cylinders (10) through reed valves (11) into the air "box" (12). Entrapped air in the combustion cylinder is also compressed, reaching the ignition temperature at the time fuel is injected. On the power stroke, the pistons are forced outward by the expansion of burning gases. This movement uncovers the exhaust ports first, allowing most of the heated gas to leave the cylinder through the exhaust tube (13). Then the intake ports are uncovered, and air from the air box flows through the cylinder, scavenging it and mixing with the hot gases in the surge tank (14). The outward moving pistons compress air in the "bounce" cylinders, and this compressed air again provides the rebound to move the pistons inward for the compression stroke. Diluted hot gases flow from the surge tank through a port (15) to the turbine wheel (16). The revolving turbine wheel supplies power to the tractor.

As the pistons move outward after the fuel charge has been ignited, outside air is pulled into the compression cylinders through butterfly and reed valves at the air intakes (17).

To activate the pistons for the initial start of the engine, a vacuum pump (not shown) draws air out of the "bounce" cylinders to pull the pistons back into the position shown. Starting "cans" (18) then provide a measured amount of air under pressure to the "bounce" cylinders to force the pistons inward for the initial compression.

Automotive Activity Remains At High Tempo on West Coast

Another big year appears to be in the offing for West Coast automotive assembly plants. The growing population in the 11 Western States will push the area's figure of 18 per cent of U. S. motor vehicle registrations to 20 per cent this year.

The year 1957 will see the West Coast getting more plant space, equipment, and workers. Eager motor vehicle company purchasing agents will spend more millions for materials and services in the area. The figure should go well above the \$225 million spent in 1956.

Extensive Conveyor

EARLY this year the Michigan Division, Thompson Products Co., moved into its new plant—a modern structure of advanced design, located in Warren Township outside Detroit. Boasting a productive floor space of some 275,000 sq ft, the plant houses the manufacture of the well-known line of tie-rods and steering gear linkage, formerly produced in Detroit; and ball joint assemblies for front suspensions of 1957 automobiles.

From a management standpoint it is of interest that the initial planning of the layout laid special emphasis upon compact, self-contained production lines and assembly machines wherever feasible. By far the most important consideration was the introduction of conveyorization and automation techniques wherever these could be applied economically. One of the major fruits of this planning is the first example—within the experience of the writer—of a Jervis B. Webb power-and-free conveyor system serving the compact forge department.

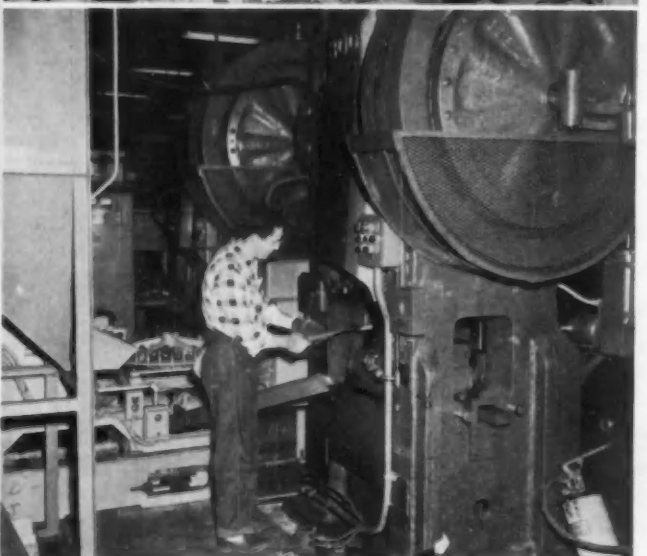
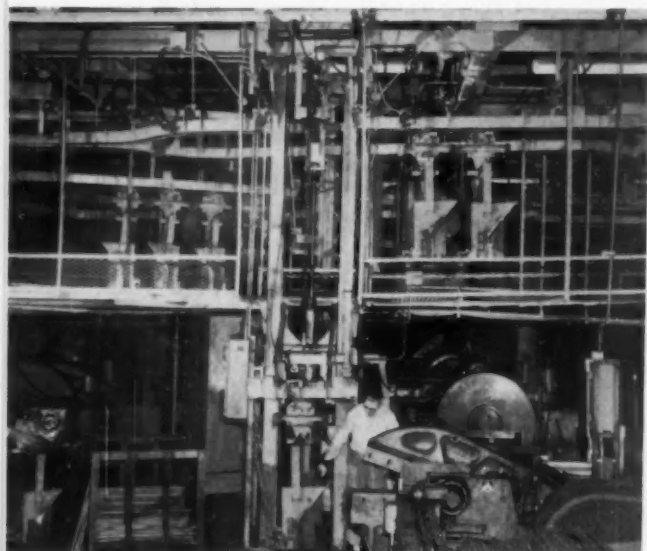
In operation, a shear operator cuts bar stock to length and loads the pieces into a carrier, then sets the station selector switch and presses the button that controls the lift section. This serves to transport the carrier to the proper free line, discharging it against a feeder-stop to await pick-up by the power line trolley. As the carrier moves along this path it actuates a switch to the free line at the selected forging station and is fed into the storage bank ahead of the drop station.

As the drop section, which is air-operated, is cleared, a loaded carrier is fed into it and is dropped

Top—A station of the forging department. Here may be seen one of the alligator shears for cutting bar stock to forging billet length. The operator is loading a carrier for transport on the lift upward to the Webb power-and-free conveyor system.

Center—View inside the forging department area, directly under the Webb power-and-free conveyor system. A feature of this setup is the automatic feeding of the Tocco induction heating unit at the left, forging billets being delivered automatically by the carriers that are lowered from the overhead station to the feeder mechanism directly over the Tocco unit. From the heating station the bars are delivered to the National forging machine at the right.

Tie rod socket forgings are produced in the area seen partly in the illustration at left. Bars are delivered at this point and are fed into the indexing table in the center background. Heating is done by means of two Tocco induction heating units, one on each side of the indexing table. Operators load the bars into the fixtures, then remove the heated bars and load them into the press as shown. Forgings are ejected automatically and conveyed to a storage bin ready for shot blasting.



Systems at Thompson Products Co.

into position on the locator-feeder. On the drop stroke of the carrier a cam on the locator-feeder engages an unlocking slide which withdraws pins that hold the bars in the carrier. Upon being unlocked, the bars drop through a slot down into the feeder.

The feeder, in turn, is controlled by the Tocco unit. Each stroke pushes a bar into the induction coil, and the leading bar, in turn, pushes a heated bar out of the coil. The return stroke of the Tocco piston actu-

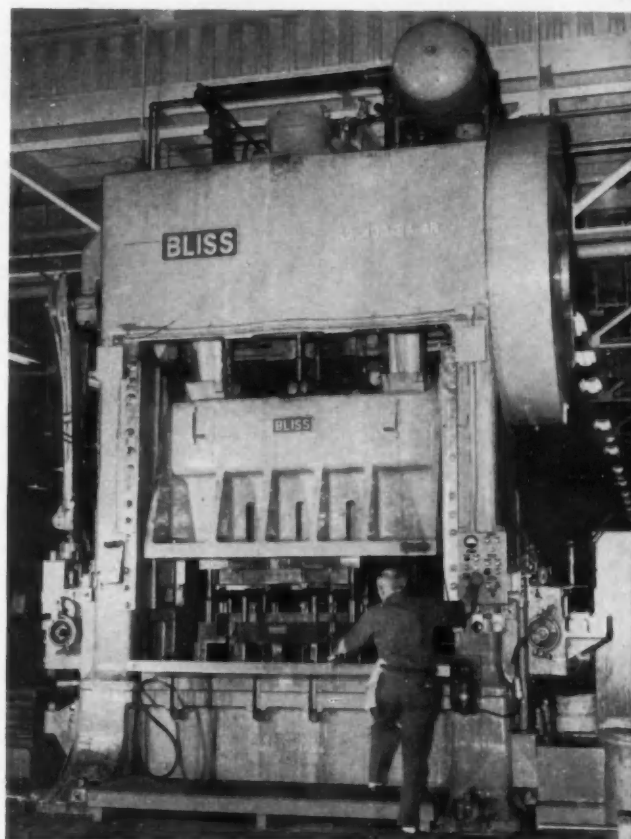
By Joseph Geschelin

ates an air cylinder on the agitator panel to replenish the supply in the bar feeder.

When a carrier has been emptied, the absence of a bar opens a switch and signals the lift section to remove the empty carrier and position a full one. If storage lines ahead of an upsetter are full, the carriers will circulate until there is room. Individual storage lines hold a two-hour supply as a bank.

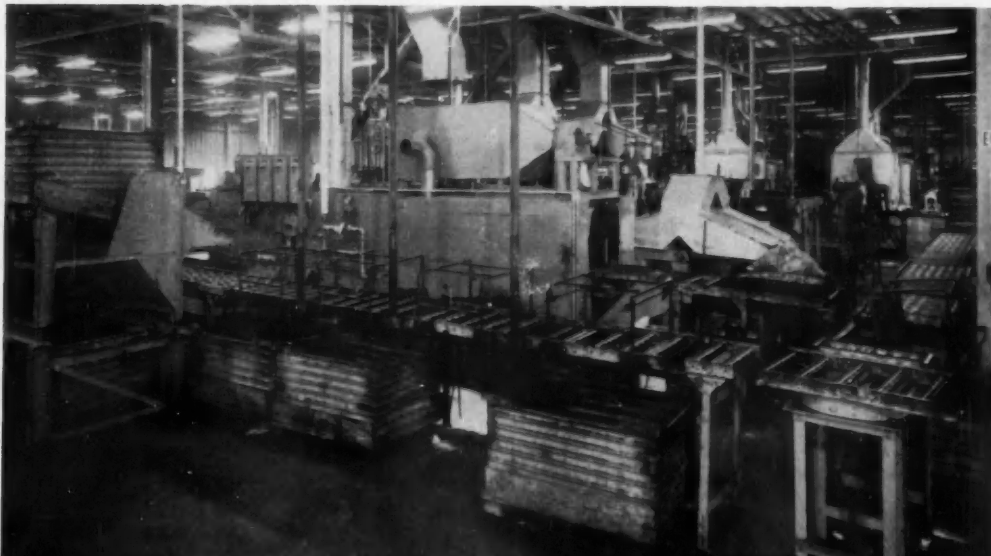
The objective of this automatic system is manifold. It eliminates manual handling in feeding the Tocco units; it eliminates the trucking or manual handling of bars from the cut-off; it permits full utilization of shearing machine capacity; it permits full utilization of forging machine capacity by providing a constant bank of bars; and it conserves valuable floor space through the storage of banks on the overhead carriers.

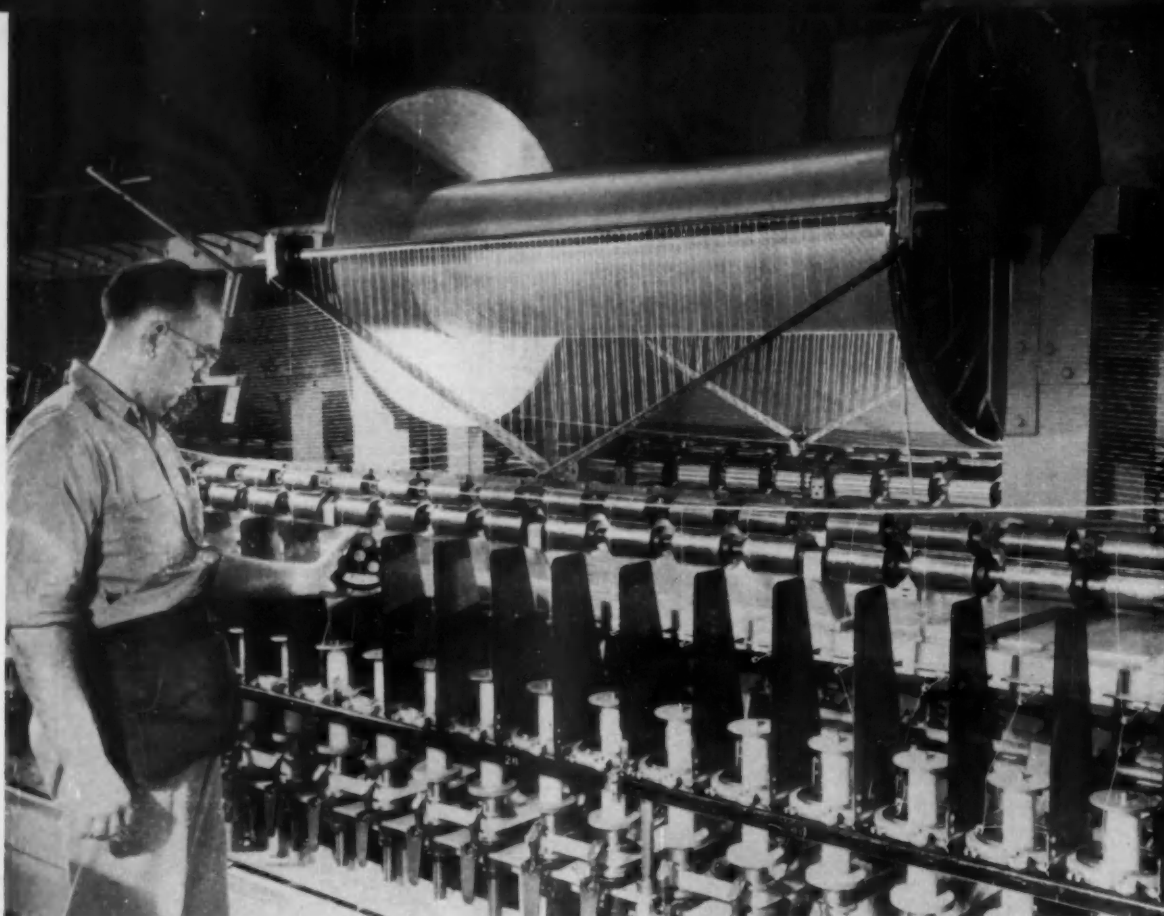
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One of the new Bliss presses found here. It is a 400-ton straight sided press used for stamping ball joint parts in a progressive die.

Perspective view in heat treating department.





One hundred and seventy-six ends of nylon yarn on beam are given approximately 12 turns per inch in initial step for production of tire cord. Twister can also be used to process single strands of nylon with tension control for each individual position.

New Developments in Tire Cord Tested in Modern Laboratory

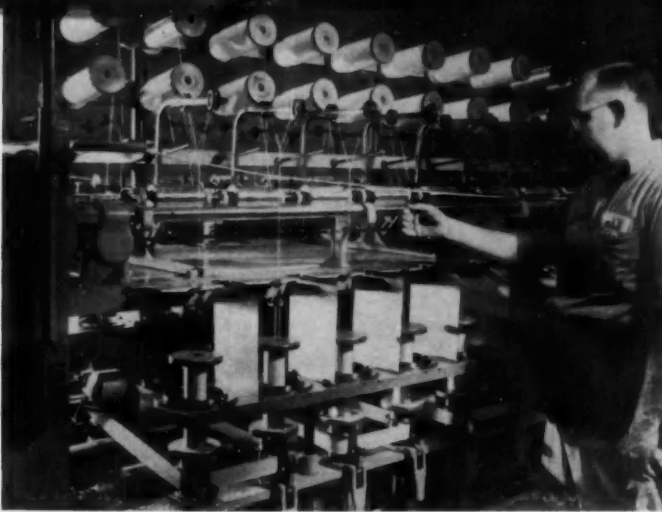
DURING the past year over 400 million pounds of rayon and nylon yarns were used in tires. This poundage was supplied by five rayon and two nylon yarn producers.

All the nation's leading airlines are 100 per cent on nylon-cord tires. Nylon is used in virtually all off-the-road equipment, approximately 30 to 35 per cent of the country's trucks and buses are rolling on nylon-cord tires, and about 25 per cent of replacement passenger car tires—including all premium tires—are reinforced with nylon cord.

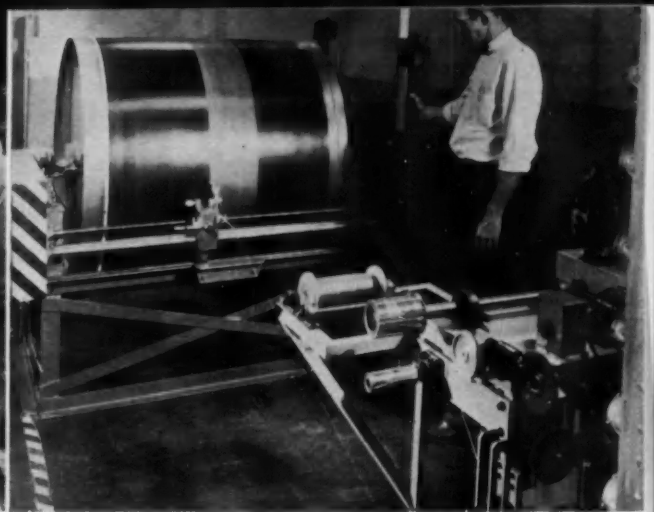
An important factor in the outlook for nylon tire cord in 1957 is the fact that major tire manufacturers are marketing nylon-cord passenger tires at prices approximately five per cent above those for rayon-cord tires of comparable construction.

Dedicated to strengthening this lifeline of transportation is Du Pont's \$2 million Industrial Products Research Laboratory at Newport, Del. Backed by the facilities of seven fundamental and technical research laboratories, IPR personnel follow the life of tire cord from the emergence of the fibers from the spinneret, through laboratory and field tests, to dismemberment for further analysis and study. The laboratory makes up to 45 tires per week for test.

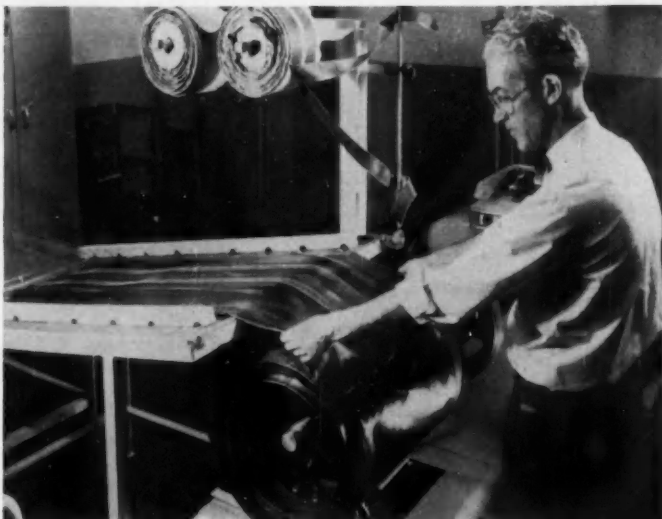
Out of the research program, a new product—now under test in the trade—called "Improved Type 700" nylon was developed. Tire tests of cord from this fiber show that a stronger, more durable tire could be built with less fiber per tire than is required with conventional nylon. Illustrated on these two pages are some of the machines used in the laboratory for tire research work.



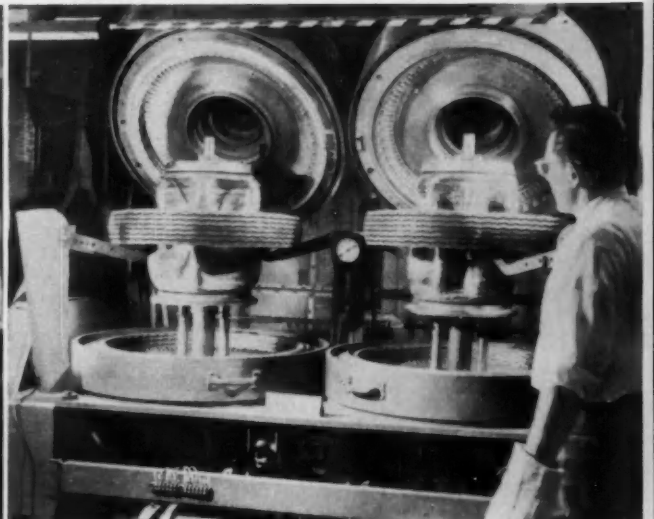
Two ends of nylon yarn are plied and twisted to insure optimum strength and flexural resistance on this 64 spindle cord twister. "Y"-shaped string up of yarns insures maximum cord uniformity.



Laboratory technique of building ply of cord fabric from a single bobbin permits construction with any given number of cords per inch for precise studies of role of new experimental yarns.



Tread stock is applied to plies of cord fabric on drum to produce body for a four-ply passenger car tire containing a new experimental yarn.



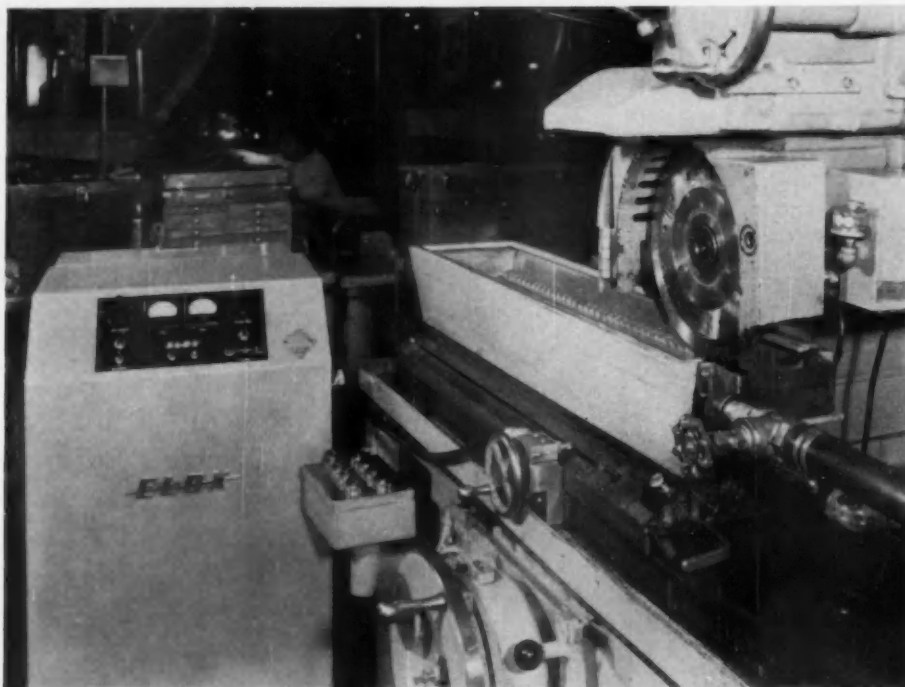
Cured tire is ready to be removed from Bag-O-Matic press for studies to determine role of cord in tire performance.

Precise measurements are made during tire test on \$80,000 test wheel equipped to determine performance characteristics of tire cord under controlled conditions.

A Scott IP-4 tensile tester is used to study yarn tenacity and per cent of elongation.



Electrical Discharge Machining Saves Time in Making Broaches



One of the two Thompson 38 surface grinders converted by Elox to the electrical discharge machining process, using an Elox 28-amp power supply

Below is a close-up of the carbide-tipped broaching tool used for broaching the turbine blades

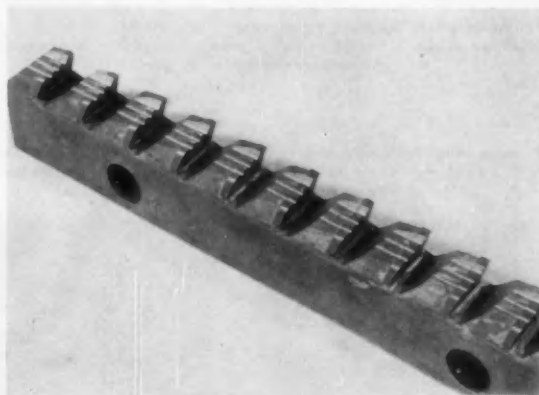
SAVINGS of around \$294 per piece in the cost of producing special broaches for finishing the pine tree form on turbine blades for the J-57 jet engine are reported by the Aircraft Division, Ford Motor Co., in Chicago, according to Elox Corp. The broach illustrated here is currently being machined by the electrical discharge method in an Elox-equipped surface grinder.

Machining of the intricate form in 32 carbide-tipped teeth to accurate dimensions by the Elox method has been reduced to a total time cycle of 33 minutes, about one-half the time required with abrasive methods. In addition to this great reduction in time, the use of diamond wheels as well as the expensive operation of forming these wheels, has been eliminated.

Brass wheels, used in the new process, are formed on the machine by means of a rough and finish form tool mounted on the table of the surface grinder.

Although a considerable saving is now reported by Ford in this operation, a much greater saving is said to be inevitable when new tools are made.

When making new tungsten carbide tipped forming



tools with the electrical discharge machining process, the necessity of ordering preformed carbide blanks, as well as preforming the steel shanks prior to inserting the tungsten carbide tips, is eliminated. This is due to the ability of electrical discharge machining to machine both tungsten carbide and steel simultaneously without injury to either one.

Testing Ignition Distributors with Electronic Equipment



ALL distributor test stand is 40 in. wide, 50 in. deep, and 7 ft high; it weighs about 2000 lb. Overall power requirement is about 4 kva at 440 volts, 60 cps, three phase.

AN electronic distributor test stand is now in use for production-line testing of fully assembled distributors at the Ford Parts and Equipment Div. plant, in Ypsilanti, Mich.

Designed and manufactured by Airborne Instruments Laboratory, Inc. to Ford specifications, the device subjects each distributor to conditions similar to those encountered in normal engine operation. Parameters of performance are flashed on the face of a 17-in. television type cathode ray tube, and an operator then calibrates the distributor.

The test stand indicates the following operational

characteristics of a distributor: dwell and dwell uniformity; advance angle vs speed; firing uniformity; and advance angle vs vacuum.

Dwell and dwell uniformity are shown by means of "make" and "break" pulses. Make pulses are automatically aligned, eliminating the need for any zero adjustment during this check. The operator sets the dwell to the proper value by adjusting the point gap of the distributor until the break pulses fall into the tolerance slot on the display mask.

Advance-angle-vs-speed characteristics are obtained by comparing the timing of the break pulses with reference pulses generated by means of a pulser wheel. Initial zeroing is accomplished by rotating the distributor housing in its clamp until the spot on the cathode ray tube falls within the calibrated mask at a speed of 200 rpm; at this speed the advance should be zero. The distributor is then cycled between 200 and 2000 rpm, and the curve is repeated with each speed cycle.

Firing uniformity is also checked during this display. If the dispersion of break pulses is wider than it should be, the firing is not uniform. Acceleration is normally adjusted to take 4 sec, but provision can be made to reduce this time to about 1 sec. Deceleration time is about 1 sec when cyclic control is being used.

Vacuum advance is shown continuously by means of a vacuum-electrical transducer operating with a vacuum source, which is included in the test stand. For this test, the distributor is run at a constant speed.

AMC to Stay in Car Business; To Diversify, Expand Further

American Motors Corp. is in the automobile business to stay. Speaking at a press conference in Detroit following a series of meetings with Louis E. Wolfson, president George Romney emphasized that AMC will pursue a hard-hitting program of acquisition and diversification, in addition to retaining its full line of cars.

Mr. Wolfson, well-known financier and chairman and president of Mer-

ritt-Chapman & Scott Corp., recently became the largest single stockholder in American Motors. He had met with Mr. Romney to discuss certain suggestions regarding the future of AMC.

It was disclosed that the two men discussed a number of specific companies that American Motors might acquire. Some of these admittedly are concerns in which Mr. Wolfson has a substantial or controlling interest. Obviously, American Motors' present \$36 million tax credit is an

advantageous factor as far as future acquisitions are concerned.

In a strong refutation of previous published speculation, Mr. Romney asserted that the Nash and Hudson lines would definitely be continued. He also denied reports that American Motors was negotiating the possible sale of its Rambler operation to Chrysler Corp.

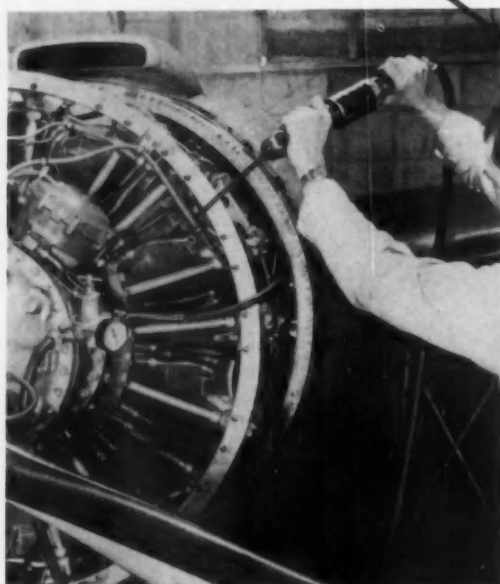
On the contrary, he said, tooling for 1958 Rambler, Nash, and Hudson models is already well underway for their introductions next Fall.



Reaming holes in the wing spar of a jet bomber



Drilling four holes in a wing spar. Drills index directly into the bushing hole.

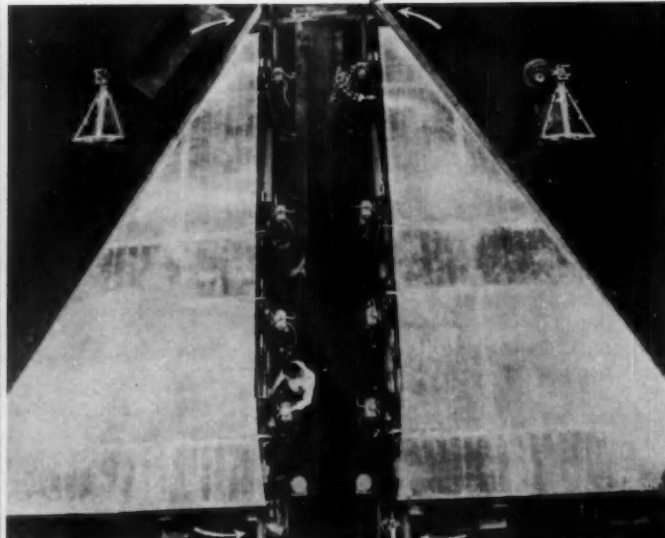
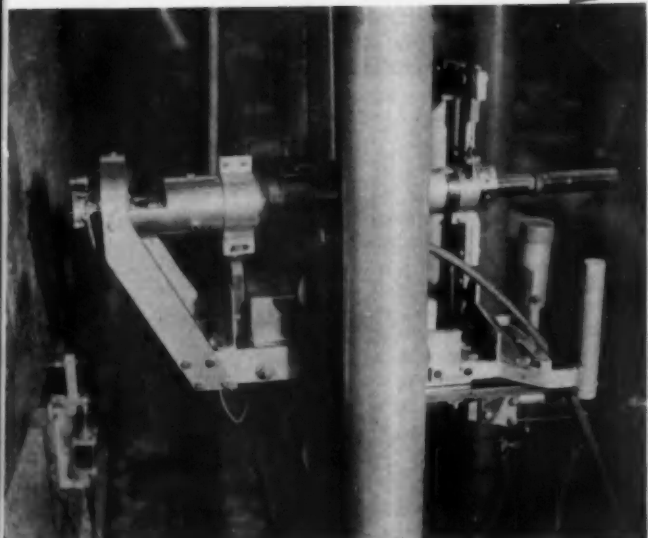


Left—Running down spark plugs to an exact specified torque or removing a used plug with a Keller double end nut setter.

Below left—self-aligning Airfeedrill developed by Martin for accurate countersinking rivet holes on wing skins. Three micro-switches (two visible in photo) are mounted at the working end of the drill to provide accuracy. Contacts remain open unless the drill is at exact 90 deg angle. Pneumatic pressure holds drill against skin. Fixing provides vertical and horizontal movement of drill assembly.

Below right—Fixture to drill and ream eight holes in the edges of the wings and drill, spotface, ream and hone two holes in the landing gear trunnion of the wing.

Versatile Air Tools



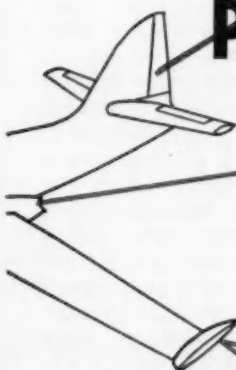
PRODUCTION versatility, one of the keys to the economic manufacture of today's constantly changing aircraft designs, is a requirement being met by the use of air tools in a variety of setups. Plants can make use of such equipment by either manual handling or by incorporating the tools in special jigs.

Air tools for drilling, tapping, honing, backspotfacing, and countersinking, as well as screw drivers, nut setters, and impact wrenches perform a host of jobs on airframes and engines. Some of the typical jobs are illustrated herewith. It is noteworthy that relatively low cost fixtures or jigs may be used in many places where air tools fit into the production pattern.

Currently, airframe production makes use of large quantities of air tools. On the Boeing B-52, 70 Keller Airfeedrills are used to drill over 10,000 holes in upper and lower fuselage panels. Each fuselage bulkhead has 250 holes drilled and reamed by air power, and 400 holes are drilled in upper and lower longerons.

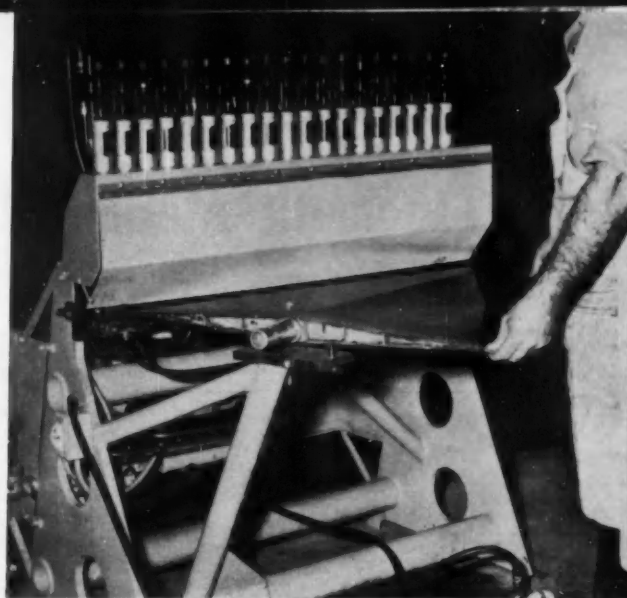
Regardless of the requirement, air tools can be made to fit into limited or high production.

for . . AIRCRAFT PRODUCTION

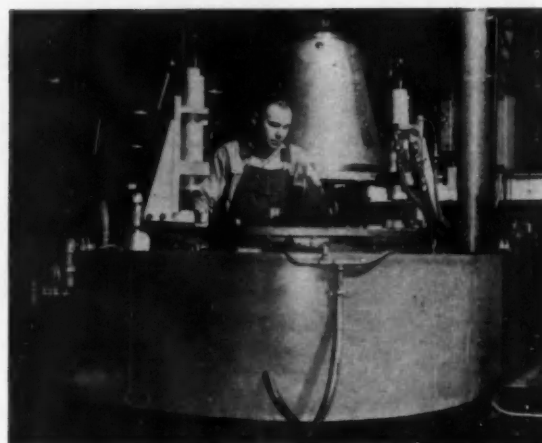


At right is shown a fixture for drilling 80 holes in a jet engine exhaust cone. Four holes are drilled with Keller Airfeedrills during each of the 20 passes controlled by the indexing mechanism.

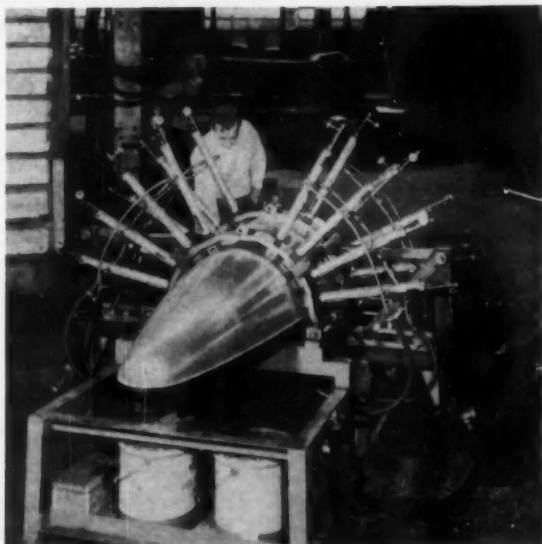
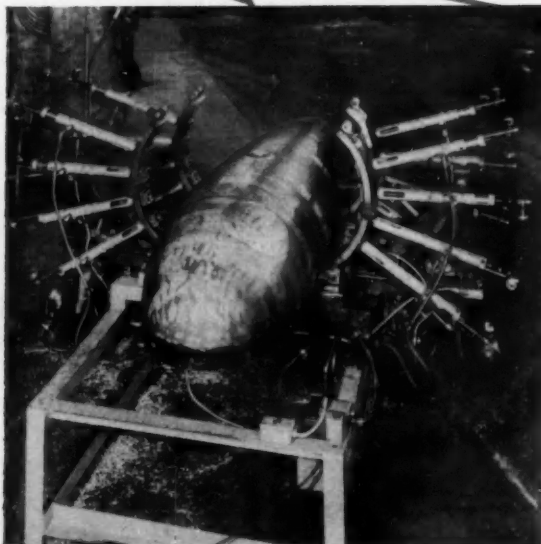
Below—Front view of fixture for drilling 16 holes in a gasoline drop tank in 23 sec.



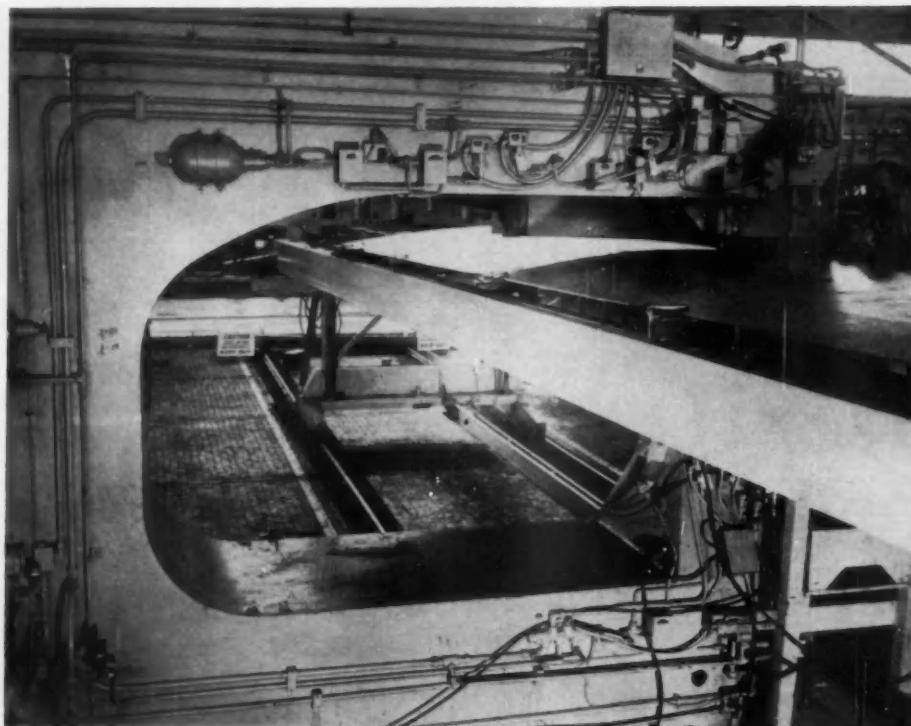
Fixture for drilling 19 holes in the leading edge and seven holes in the trailing edge of a fin in 36 seconds with Keller "Airfeedrills."



Below—Rear of fixture for drilling 16 holes in drop tank.



Automatic Machine for Drilling and Riveting



The Drivmatic machine drills, chamfers, rivets, and mills in a continuous operation. Work may be positioned in any plane.

MARTIN'S new Drivmatic riveting machine, which automatically drills and rivets the stringers to the 10 by 37 ft wing panel of the company's P6M SeaMaster multi-jet seaplane, uses refrigerated slug-type rivets.

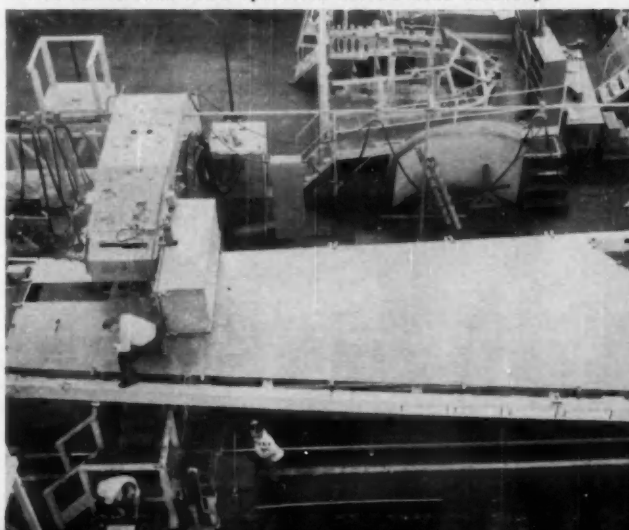
Drilling and riveting by automation were developed as a step toward fuel tightness so that the wing itself can be used as a tank without the need of a liner or secondary fuel container being installed. In the automatic riveting process, no sealant is necessary. The Drivmatic machine clamps the workpiece in position, drills and countersinks the rivet hole, injects the slug rivet, upsets the bottom of the slug, upsets the top into the countersink, mills the top head flush with the wing surface, unclamps the workpiece, and resets itself for the next sequence.

A tape command device is used to control the entire operation. Coded holes punched in seven different channels of a standard 35-mm motion picture film pass beneath electrical contact regulating the functions of the equipment, the contracts translating the holes into electric signals. Holes are located on the tape by manually positioning the assembly in relation to the tape and by using a hand tool to pierce the

holes. Accomplishment of the operations of the tape command is effected by electromechanical and hydraulic.

(Turn to page 115, please)

This tape controlled drill and rivet fixture uses refrigerated slug rivets to join wing panels and stringers seven times faster than same operation can be done manually.



AUTOMATION NEWS REPORT

← FEEDBACK →

**AUTOMATIC CONTROLS
PRODUCTION — VEHICLES — AIRCRAFT**

By Samuel Cummings

GIANT ELECTRONIC BRAIN

A large-scale computer that is equally capable of solving engineering or business problems was recently unveiled by International Business Machines Corp.

The new machine, designated IBM 709, is the latest addition to the company's 700-series of electronic data processing systems. As examples of its versatility, the company stated that the 709 computer will be able to pinpoint the best location for a new plant, forecast sales, and perform a variety of routine and specialized accounting operations.

The first order for the new system, it was revealed, came from Union Carbide and Carbon Corp., which will use it to help management make decisions relating to current operations as well as future planning.

An outstanding feature of the 709 computer is its flexible programming system which enables it to handle data prepared in machines using numbers different from the 709's basic system of binary arithmetic. Because of this, IBM says, "all problem data can be kept in whatever form is most economical and desirable for the work at hand, rather than in a number system compatible to the computer."

The device's magnetic memory can store up to 32,768 "words" of problem or instruction data, or the equivalent of over 327,000 decimal digits. Any word in core storage, the announcement states, can be dug out for use in 12 millionths of a second.

EUROPEAN COMPUTATION CENTER

Electronic Associates, Inc. will open an analog computation center in Brussels, Belgium, sometime this summer. The center will stock the latest in EAI analog computers, and a staff of computer specialists will be on hand to operate them. Equipment and staff services will be rented to firms throughout Europe on an hourly, weekly, and monthly basis.

The staff will be composed of scientists, engineers, and mathematicians who will evaluate, set up, and solve problems submitted to the center. When special problems are encountered, European specialists from research institutions and universities will be called in. These specialists will follow the problem from

the preparation stages, through computer processing, to the final analysis of results. They will then prepare a comprehensive report with recommendations for the client.

EAI officials believe that the computation center will stimulate European interest in analog computers and, at the same time, they hope that many rental customers will become buyers.

SUMMER COURSES

Wayne State University's Computation Laboratory again is offering summer courses in computer theory and practice. This year's program will once more consist of three weekly courses, as follows: Introduction to Computers and Their Applications (June 3-8); Data Processing in Business and Industry (June 10-15); Industrial and Management Computer Applications (Sept. 9-14). For more information write to A. W. Jacobson, Director, Computation Laboratory, Wayne State University, Detroit 2, Mich.

DATA PROCESSING SYSTEM

The Ordnance Tank Automotive Command has installed at Detroit a \$4.1 million electronic data processing system, called Bizmak and developed by Radio Corp. of America, to give finger-tip information on the 170,000 separate items in Ordnance stocks throughout the world.

OTAC's mission is to supply spare parts for about 1 million pieces of tank and automotive equipment, which includes 145 different basic vehicles and more than 1200 models. Keeping track of paper work and physical handling has been a monumental task. Reporting forms under the previous punch card system required about 250,000 sheets a month, equal to a stack 60 ft high. With Bizmak, the pile boils down to about two inches.

Principal advantages from the system are almost immediate availability of stock data, reduction in personnel, and a substantial cut in inventory required without impairing field service. Bizmak sifts the data to make sure supplies are at the right place at the right time to prevent both costly surpluses and critical shortages.

The system can, at electronic speed, take inventory, catalog spare parts, prepare manuscripts for catalogs, forecast supply requirements, detect impending shortages or maldistribution, and produce budget summaries. For example it can:

Take a complete inventory in 48 hours that formerly required three months;

Make a price calculation in 30 minutes that once required five weeks by a clerk;

Process as much data in one hour as 400 operators with hand calculators;

Print shipping orders and other paper work at high speed;

Record on and read from magnetic tape at the rate of 1700 words a second;

Store on one 10½ in. reel of tape as much data as

(Turn o page 112, please)

Cold Forming at Fellows

THE Appel cold forming process has been brought to the U. S. and Canada through a license acquired by Fellows Gear Shaper Co. The Springfield, Vt., firm will build the machines which knead or plasticize ductile metals at relatively low temperatures—less than 150 F.

The machine transforms the orig-

inal shape of the unworked material into the finished product shape by the action of forging elements which,

under control, increase the uniform circumferential pressures on the outside surface of the work with each stroke.

Parts which can be produced to the greatest advantage are cylindrical pieces where bores of close tolerances with a high degree of surface finish are required. The surface finish produced is 8-10 micro-inches, although a finish of somewhat better than two micro-inches can be obtained. Tubular parts with a cylindrical outside diameter where the bore has a contour, such as internal splines or square holes, are relatively easy to make.

The three basic rules for high-speed precision forging have been incorporated in this eccentric operated prism machine. These rules are: radial stroke with radial acting balanced forces; time controlled kneading of the material; controlled movement of hammer elements, eliminating rebounding.

The Biggest Ladle Crane

A LADLE crane of 500-ton capacity, designed and manufactured by Morgan Engineering Co., is going to work in a large eastern steel mill. The crane has sufficient power to lift over 300 automobiles at one time. With ladle attached, it could carry enough molten steel to manufacture 250 complete automobiles. Over 10,000 engineering man hours went into the design of the crane. Some of its details are:

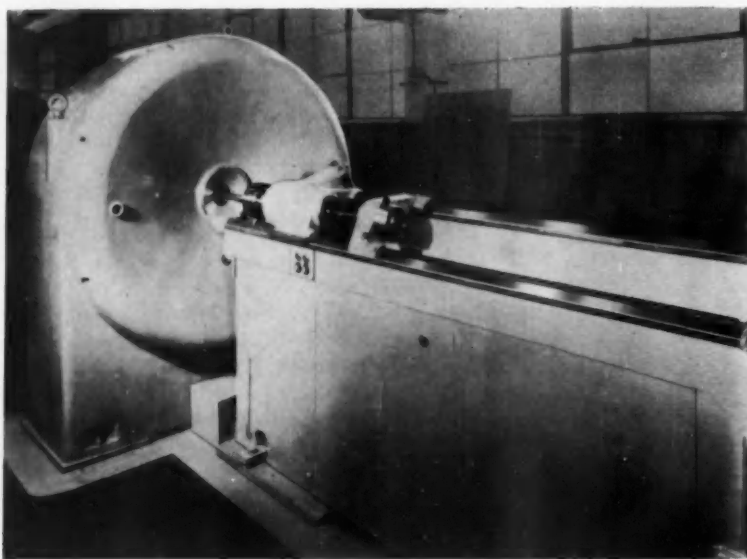
Weights 1,841,000 lb excluding ladle and hot metal.

Driven by 11 electric motors totaling 1658 hp.

Reeved with 1 2/3 miles of steel wire rope or cable.

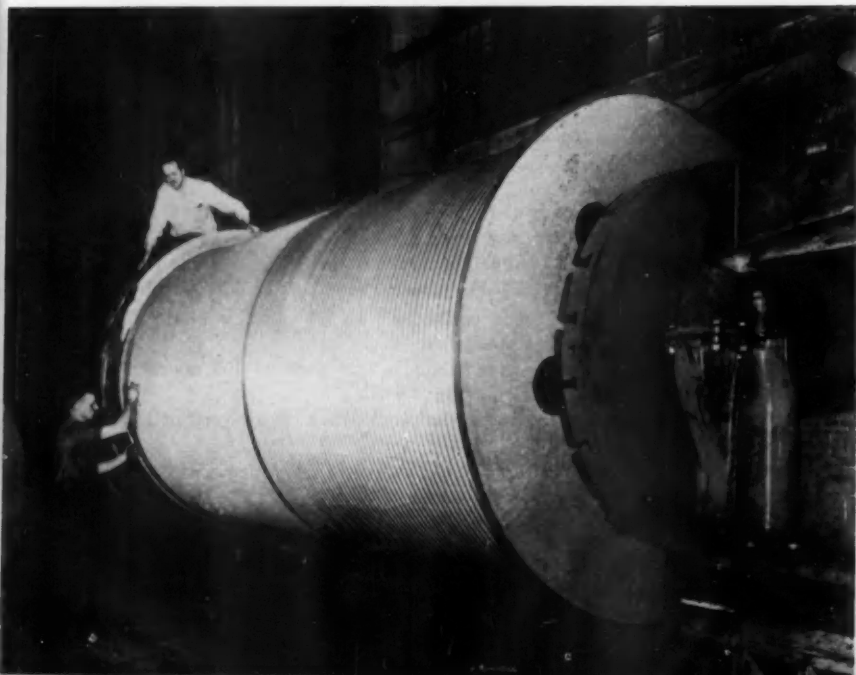
Handles a ladle having a 17-ft top diam, 13-ft 10 in. bottom diam, 17-ft, 3 1/2 in. height.

A cage of 31,300 cu ft is required to house the crane's electrical control, auto-pour equipment and operator.



Fellows-Appel cold forming machine.

Setup for machining grooves for wire rope on one of the two main hoist drums on the Morgan 500 ton ladle crane.



Huge Machines Developed for the Handling of Out-sized Workpieces. Special Equipment Announced for Unusual Operations. Axle Shafts Made on Automated Lathes

Canadians Automating UK Automobile Industry

A CANADIAN manufacturer has built two 11-station transfer machines, three duplex trunnion machines and a two-way horizontal drilling machine, all for special purpose application United Kingdom automobile plant. Engineered and built by Standard-Modern Tool Co., Ltd., the transfer machines are the first of their type ever built in Canada for use in Great Britain. The two 11-station transfer machines were designed to perform 36 drilling, reaming, milling, facing, boring, chamfering and tapping operations on automotive crankshafts. Production rates for both are 48 shafts per hour at 80 per cent. One machine was built to produce shafts for four-cylinder engines; the other makes them for six-cylinder units.

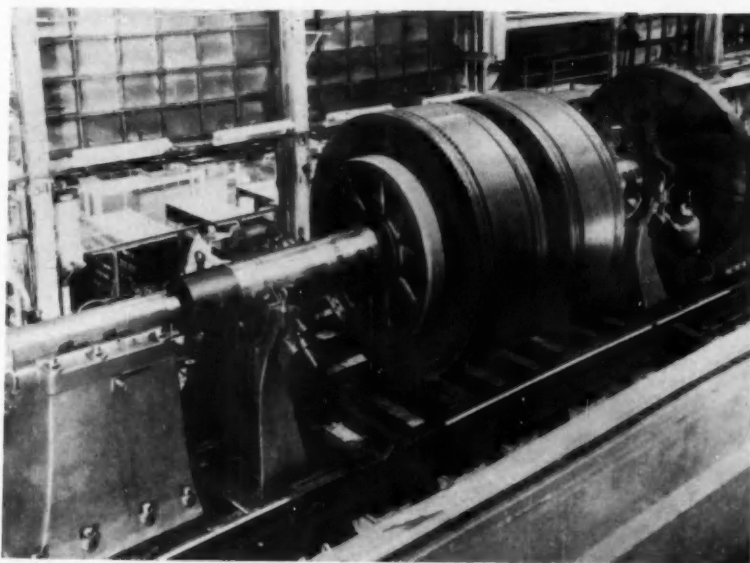
Westinghouse Cuts Big Jobs

RECENTLY installed as part of a \$1 million-plus improvement and expansion program at the East Pittsburgh plant of Westinghouse Electric Corp. is one of the largest lathes of its type in the country. It measures 50 ft in length and is capable of handling jobs up to 15 ft diam. Shown in the illustration is a 104-ton double-armature undergoing shaft refinishing. A precision instrument despite its size, the lathe trimmed less than 0.010 in. of metal from the shaft, permitting it to be set in its original bearings without expensive modifications. The capacity of the lathe made it possible to do the job without dismantling the armature.

The world's largest floor-type horizontal boring, drilling, and milling machine with 10-in. diam spindle and 18-in. square underarm was recently shipped to an eastern steel company by Giddings & Lewis Machine Tool Co. Weighing over 200-tons with a headstock alone which equals the weight of a 60 passenger airliner, the new 1200 Series precision horizontal is 27-ft high. This huge horizontal has an overall spindle speed range of

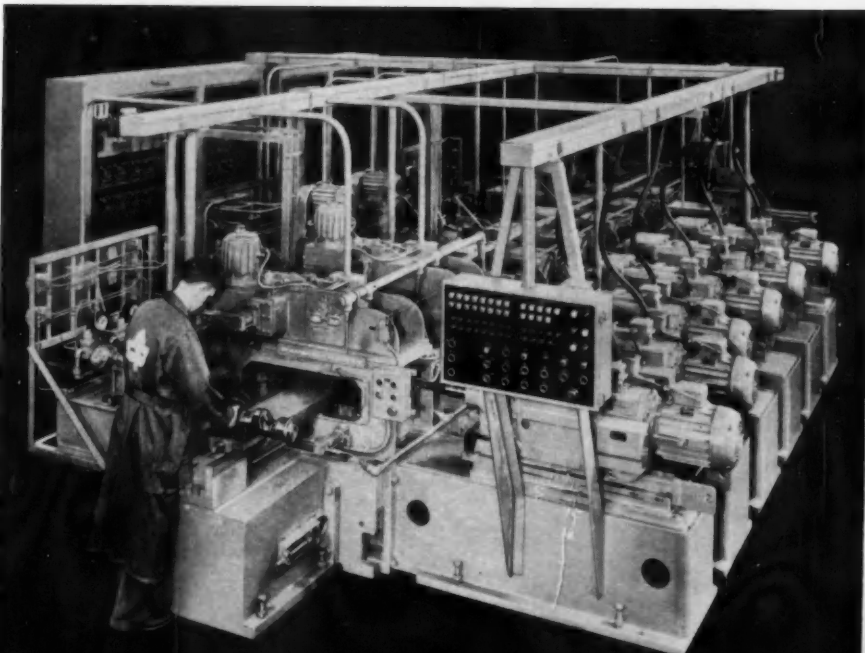
1.56 to 400 rpm. Milling feeds to the column and headstock vary from 0.5 to 120 ipm. The massive headstock

houses the speed drive gears and helical bull gear. The 18-in. square underarm makes possible the mounting of accessories, such as the two-ton 90 deg angular milling attachment and anti-friction spindle support. The underarm obtains its power feed from the spindle feed mechanism. Arrangement is made to feed the spindle independent of the underarm, or vice versa. In addition to a 100 hp spindle drive motor, there are a column feed motor, headstock feed motor, spindle



Giant lathe installed at Westinghouse shop can handle jobs up to 50 ft in length and 15 ft diam.

Eleven station transfer machine built in Canada for the automobile industry in the United Kingdom. This machine will be used for six-cylinder engine crankshafts.



News of the MACHINERY INDUSTRIES

(continued)

feed and traverse motor, and several smaller auxiliary motors.

One Way Motor Runs Tools Both Ways

ETTCO TOOL Co. and Warner Electric Brake & Clutch Co. have come up with a lead screw tapping unit that automatically reverses while the motor runs in one direction. The unit is made up of a multiple spindle Ettco-Emrich tapper and Warner fractional horsepower forward and reverse clutches. Torque output of the clutches can be varied by a rheostat. The armature of the downfeed clutch is keyed to the continuously

running drive shaft of the motor. the rotor is mounted on the lead screw, and the stationary field is mounted on an internal bracket. On the reversing clutch, the armature is bearing mounted on a sheave driven by a V-belt from a reversing idler pulley, the rotor is keyed to the lead screw, and the stationary field is mounted on a bracket.

When the downfeed clutch is energized, current flows in the stationary field. Magnetic flux passes through the rotor (keyed to the lead screw) and locks it to the armature (keyed to the motor drive shaft) in full magnetic couple, thus driving the lead screw and tap through the work. When it

reaches the depth for which it is set, a snap-acting switch is actuated and the downfeed clutch is de-energized while the reverse clutch is energized.

Lo-Swing Automated for Rear Axle Production

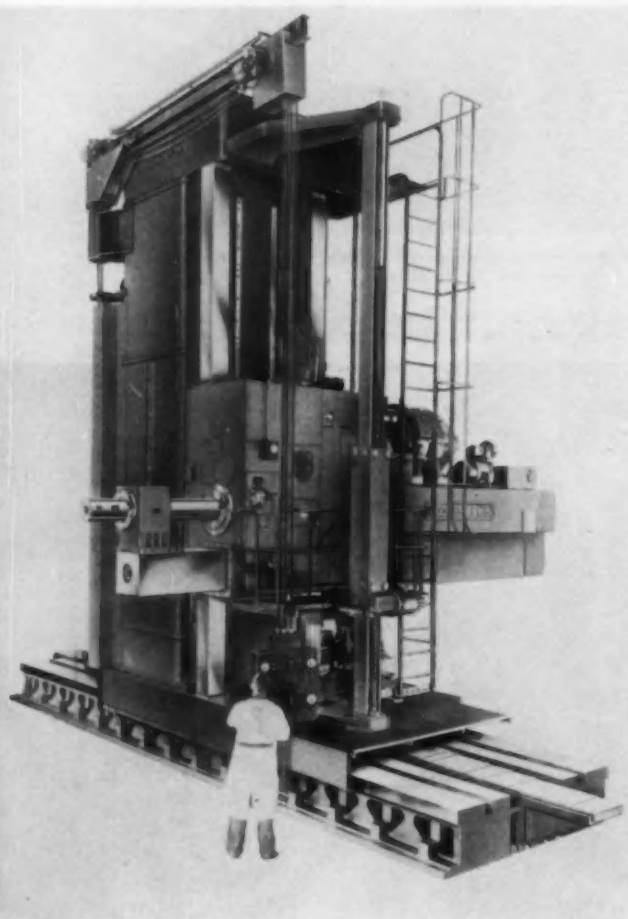
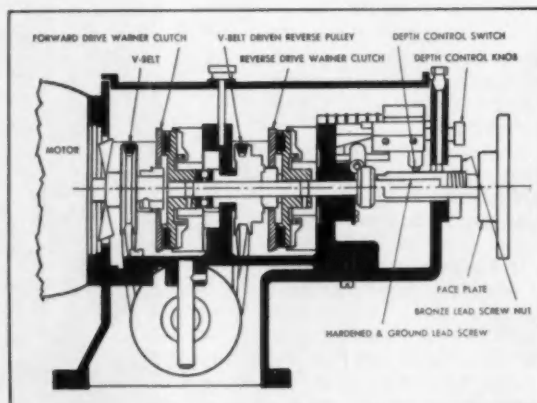
SENECA FALLS MACHINE CO. recently built four automatic Lo-Swing lathes with special chip-handling beds for automated rear-axle shaft production. Each is complete with necessary tooling; automatic gaging station; work transfer and work loading equipment; conveyor lines; and control panel for coordinating the movements of the loading and transfer equipment. The V-shaped transfer carrier has two sets of arms and fingers. The right-hand fingers are mounted on the loader arm, while the left-hand fingers are mounted on the unloader arm. The V-shaped casting guides the loading and unloading fingers to the center line of the machine when the arms are alternately lowered for loading and unloading purposes.

The transfer carrier moves back and forth, between the work pick-up and machine loading stations, on overhead rails which are under an enclosure which also houses the transfer drive mechanism. The transfer drive mechanism as well as the loader arm and fingers is mechanically operated and positive in action.

The rough axle shaft forgings arrive by chain conveyor at the pick-up and gaging table, one of which is attached to the tailstock end of each lathe. The rough parts are automatically dropped into shuttle cradles "A" which are mounted on endless chains operated in a shuttle movement. With proper timing, the cradles "A" move forward to a position in line radially with elevator cradles "B" which are shown retracted to allow cradles "A"

Giddings & Lewis floor type horizontal boring, drilling, and milling machine which is said to be the world's largest is being used by a large eastern steel company.

Cross-sectional view of the lead screw tapping unit developed by Ettco Tool and Warner Electric. This shows the arrangement of the forward and reverse clutches as well as the depth control.



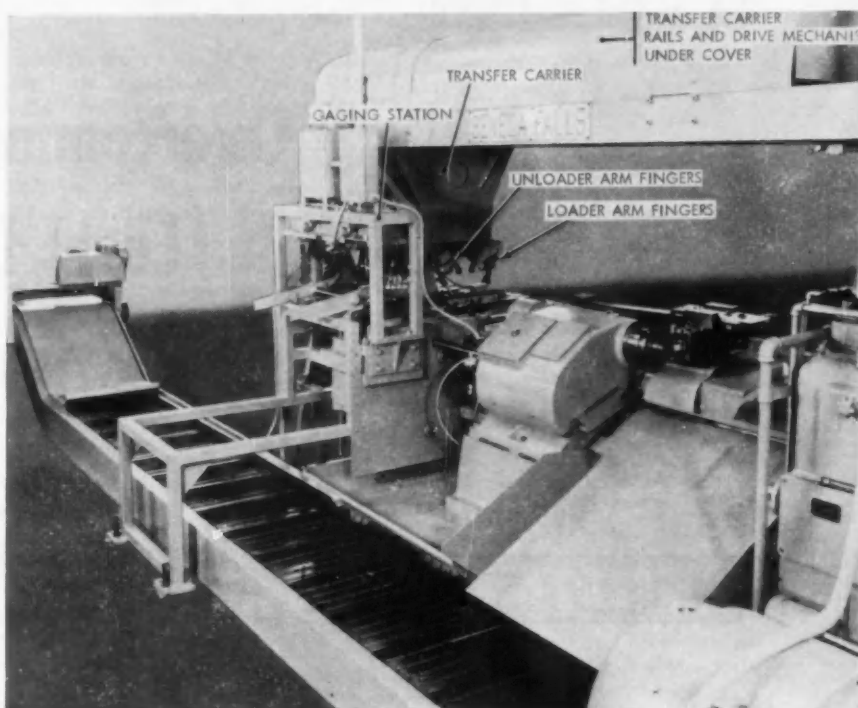
and the rough workpiece to pass over them.

At this time the transfer carrier is positioned just over the pick-up table and the rough shaft is elevated by cradles "B" into the loader arm fingers which close on contact with the shaft. The transfer carrier then moves forward to the loading position. The unloader arms then descend; the unloader fingers grasp the finished axle shaft; the tailstock center retracts and the unloader arm returns to the retracted position. The loader arms with the rough shaft then descend to the center line; the tailstock center advances to support the shaft; the finger latch is tripped by the tailstock quill to release the fingers and the loader arm returns to the relieved position. The headstock spindle clutch is then engaged and the machining part of the cycle begins.

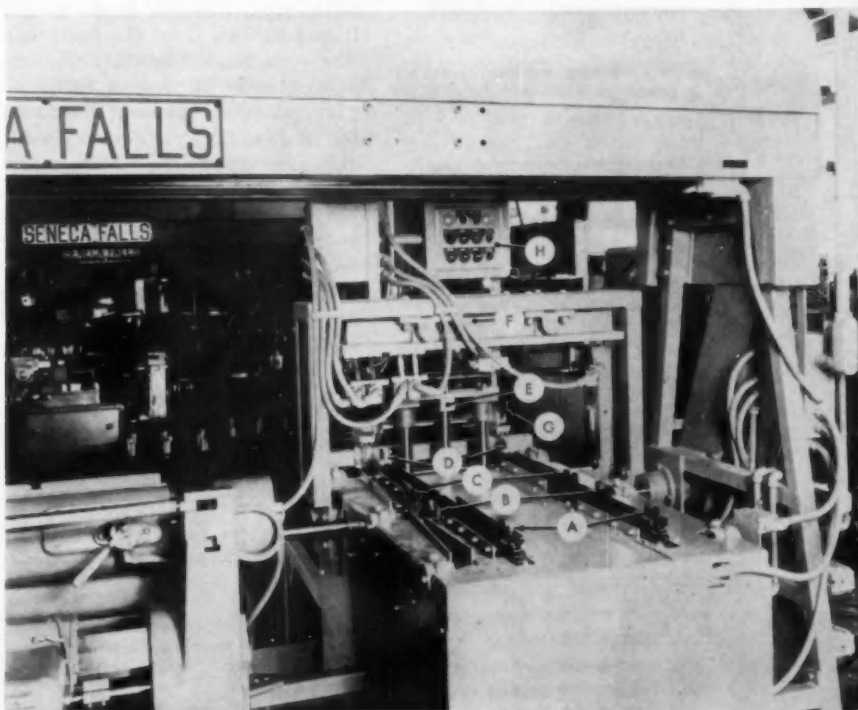
The transfer carrier now returns to the pick-up station. At this point, elevator cradles "B" and "C" are raised, cradles "B" load a rough part in the loader fingers, as previously explained, while the unloader fingers are unlatched and the finished shaft is released into the raised elevator cradles "C." Elevator cradles "B" and "C" then descend and the finished shaft is lowered into shuttle cradles "D" which are radially in line with elevator cradles "C" at this time.

The transfer carrier then moves forward to the loading position. In the meantime, shuttle cradles "A" and "D" return to the position. Cradles "A" receive a rough shaft, while the finished shaft is raised from shuttle cradles "D" by gage elevator cradle "E" and thrust into the gaging station "F" which carries the necessary gaging heads. If all dimensions gaged are within the tolerances, the gage elevator cradle descends and the finished part is released on the spring-loaded swivel levers "G" which guide the parts into a chain conveyor and to the next machine. If the finished part is off-tolerance it will remain locked in the gaging station and the machine will automatically stop at the end of the next machine cycle. The letter "H" identifies the gaging signal light panel and in case of off-tolerance dimensions, a signal light will show which dimension is off-size. The lights in the center row will show oversize dimensions and the lights in the bottom row will show undersize dimensions.

The axle shafts are driven from a clover leaf recess forged into the outside flange of the axle shaft. Headstock spindle positioning is automatic so that the work driver nose piece will always enter the clover leaf recess



Seneca Falls Lo-Swing lathe for automated handling of rear axle shafts has two sets of arms and fingers on the V-shaped transfer carrier.



Operation of the Seneca Falls automated lathe is explained in the text by letter designation.

before the spindle clutch is engaged. Production on each machine is timed

for 180 shafts per hour at 100 per cent efficiency.

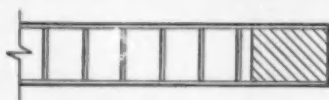


Fig. 1—Solid bar edge member

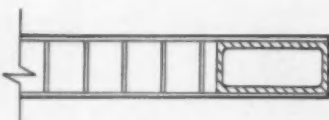


Fig. 2—Hollow extruded edge member

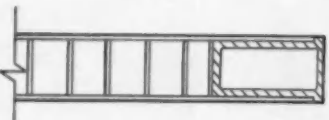


Fig. 3—Milled shape edge member

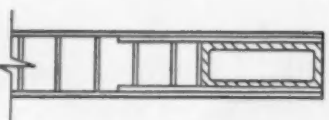


Fig. 4—Doubblers at panel edge

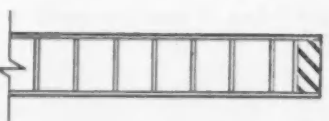


Fig. 5—Polymerizing material used for edge closeout

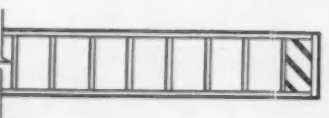


Fig. 6—Plate affixed to panel edge by elastomeric compound

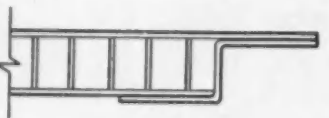


Fig. 7—Z-section used to close edge

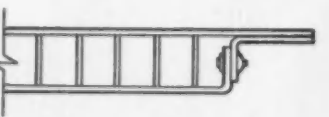


Fig. 8—Lower face of panel flanged and blind riveted to flange of an angle

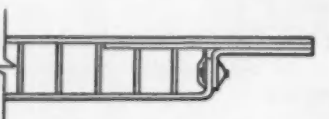


Fig. 9—Doubler added to design shown in Fig. 8

Overcoming Effects of Local Loads in Sandwich Structure

By R. W. Spencer and T. F. Freeman
Senior Research Engineers

NORTH AMERICAN AVIATION
Missile Development Div.

WHEN aircraft engineers first developed sandwich-type skins for aircraft control surfaces, they knew they had something good, but not good enough. It was obvious from the beginning that such bonded fabrications, employing cores of various foams or a honeycomb structure of aluminum foil or glass fiber reinforced plastic, did not have the compressive strength to resist high local loads. Bolts, rivets, screws, and other mechanical fasteners tended to crush or distort the structure. Similarly, these fabrications did not have the toughness to withstand high impact loads against their unprotected edges.

In the early stages of development, the first problem was overcome by the stopgap method of using large washers under the heads of bolts or screws, thus distributing the load over an increased area. The shortcomings of bonded sandwich fabrications were finally overcome when engineers developed a series of edge member, insert, and joint designs which have rapidly become standard throughout the industry. The more common designs used in missile and heat-resistant structure are described elsewhere in this article.

The primary concern of aircraft engineers in structural sandwich design is the edge member. This

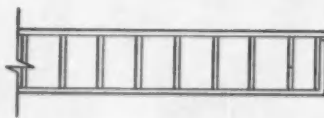


Fig. 10—Pan configuration used as the lower face to close out panel edge

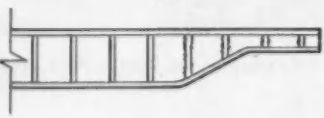


Fig. 11—Core crushed to form a higher-density edge

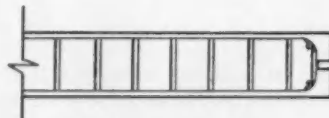


Fig. 12—Chem-Milled facing; this design requires close tolerances

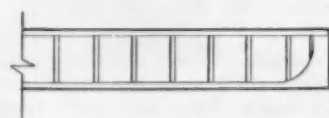


Fig. 13—Chem-Milled facing which has few points of critical tolerance

component protects the core material from damage due to such things as dirt and moisture, and reduces the chance of the panel being crushed or dented when it is hit. In addition, the edge member transmits shear loads and also provides a means for joining one panel to another or to supporting structure.

Edge Members

The following types of edge members have been used to advantage in recent structural sandwich designs.

The simplest type is the solid bar, which is generally of aluminum in aluminum faced/aluminum honeycomb core sandwich (Fig. 1). It offers the advantages of a high bearing strength and high impact resistance; and it can be drilled and tapped for fastening. It should be used primarily where shear transfer and fatigue are not critical. Its disadvantages are its weight and the fact that tooling is generally required for proper alignment of the bars during final cure of the sandwich.

In the manufacture of one or two panels, wooden pins or dowels may be tamped (flush with the panel surfaces) in guide holes drilled, in two or three places in each bar, through the faces and edge members to align the edge member during cure. However, because this process requires extreme care, tooling is required if the work is to be done on a production basis. Where four sides of a panel are to be edged with solid bar, No. 40 holes are drilled through the bar

to allow the escape of volatile matter from the adhesive during final cure. For best results, these holes are drilled approximately 4 in. on center. This rule may be ignored only when adhesives are used which produce little or no volatile matter during cure.

When the design employs Fiberglas honeycomb core and Fiberglas facings, a solid Fiberglas laminate

may be used in place of the solid aluminum bar. This type cannot, of course, be tapped like solid aluminum bar.

If tapping is not necessary for fastening, and weight is critical, a hollow extruded shape may be used. Figure 2 illustrates this construction.

The hollow extruded shape is generally of aluminum and has all of the advantages and disadvantages of the edge member shown in Fig. 1, with two exceptions. It is much lighter. It does not have the compressive strength of the solid bar. Thus care must be taken in the installation of bolts or rivets to avoid damage to the panel. Like the first, this type of edging should only be used where shear transfer and fatigue are not critical.

To avoid the "peel-prone" qualities (i.e., peeling of the face from the edge of the panel) of these designs a milled shape may be substituted as shown in Fig. 3. This shape, like those shown in Figs. 1 and 2, requires that the core material thickness be held to a very close tolerance; it differs from the others only in that the length and width of the facings must also be held to close tolerances for proper fit. Thus, it should be used only where the tendency toward "peel" is critical.

In panels subject to critical shear loads, shear may be better transferred from core to edge member by using doublers above and below the core at the panel edge. This method, Fig. 4, while presenting an edge which is lighter than solid bar and stronger than the plain hollow extruded shape, has the disadvantage of requiring that the core be undercut to allow for the doublers.

Where operating temperatures of 250F are not to be exceeded and no riveting or bolting is to be done on the edge of the panel, a polymerizing material, such as an epoxy-base putty, may be utilized for edge closeout. Puttied edges are advantageous in that they can be applied to a panel of any shape at any time and do not require that the core material be held to a close thickness tolerance. These polymeric putties are somewhat brittle, however, and should not be used where

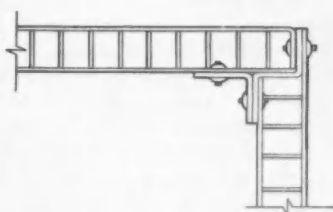


Fig. 18—Flat facing is protected from peeling forces in this design

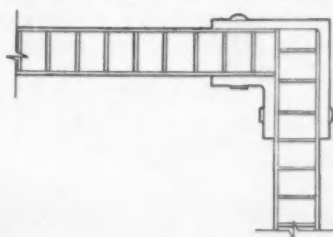


Fig. 17—Double angle method of joining

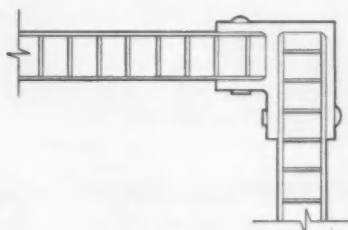


Fig. 16—Modification of T-section extrusion shown in Fig. 14

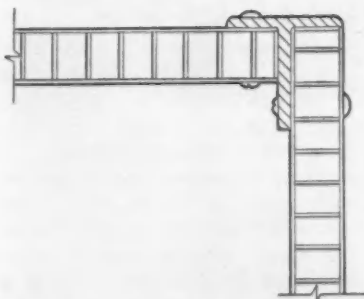


Fig. 14—Design generally used for construction of boxlike shapes

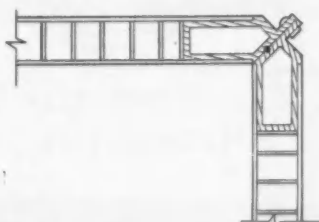


Fig. 15—A specially extruded edge member is used here

panel edges are subject to high impact loads.

Where expected conditions are the same as those outlined for the edge configuration shown in Fig. 5 but where impact resistance is required, a thin aluminum or micarta plate affixed to the panel edge by means of an elastomeric compound, such as "3M's" EC-801, may be used. This design, Fig. 6, cannot be used, however, when operating temperatures up to 250F are anticipated.

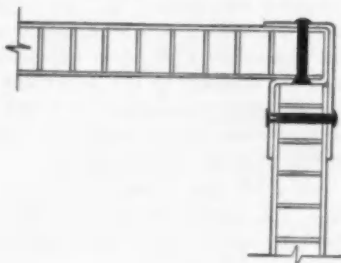


Fig. 19—Angle and Z-section joint

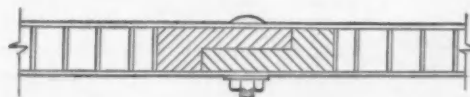


Fig. 20—Simple method of joining edges of panels

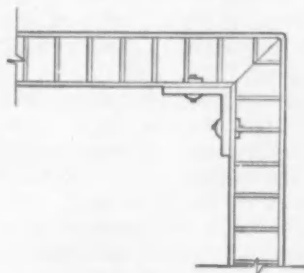


Fig. 21—A type of corner for light loads



Fig. 22—Splice of panels



Fig. 23 — A doubler which may be crushed into position

In lightly loaded or nonload bearing sandwich configurations, Z-sections, Fig. 7, either formed or extruded, may be used to close out the panel edge. While this is a simple method of closeout, which can be either riveted or adhesive-bonded in position, it does have the marked disadvantage of requiring that the height of the Z-section and the thickness of the core material be held to a close tolerance.

To avoid this, the lower face of the panel may be flanged on four sides to form a pan which, after final cure of the panel, may be blind riveted to the flange of an angle, as shown in Fig. 8. This configuration may be given greater shear transfer properties by use of a doubler, as shown in Fig. 9.

Another method utilizes a pan configuration as the lower face to simply close out the panel edges. One of the main disadvantages of this design (Fig. 10) is the "peel prone" upper facing. Wherever possible, it should be protected

from peeling forces in its attachment to supporting structure.

Where the core material is considered to be a filler only, and no shear properties are required, an edge configuration may be used wherein the core is crushed to form a higher density edge (Fig. 11). Because matched metal dies are required to crush the core edge to proper thickness, this process can only be considered for production

items. The edges may be lightly riveted or bolted.

Probably the greatest structural integrity in sandwich panel edges can be realized by Chem-Milling one or both faces of the sandwich (Figs. 12 and 13). Chem-Mill is a chemical etching process developed by North American Materials Research and Process Development group at Downey, Calif., plant.

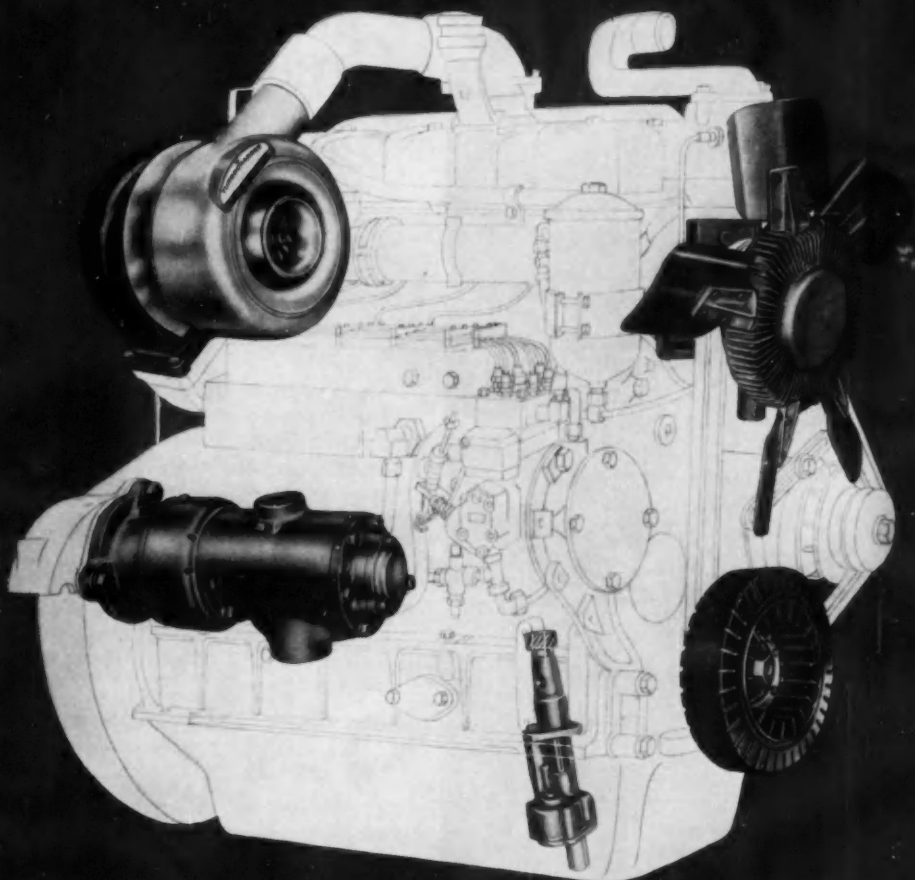
Of the two types of sandwich with Chem-Milled facings the one shown in Fig. 13 is by far the easiest to produce because many points of critical tolerance have been eliminated. The core may be fitted to the large Chem-Milled radius by beveling the edge of the core and compressing to final contour or by the Kellar Duplicator method for core shaping.

Joints

Designs of sandwich joints (i. e., methods of joining one sandwich panel to another or to supporting structure) are generally developed for a particular application and are seldom applicable to other sandwich designs. This is especially true in missile and control equipment design, due to the limitations of environmental parameters such as temperature, pressure, loading, etc. It is not the purpose of this article to attempt to cover sandwich panel joint designs in detail, but only to mention a few of the simpler and generally accepted designs. For purposes of clarity, we will consider all such designs as being part of a box-like configuration and will divide them into two categories: those which require specially extruded edge members (see Figs. 14, 15, and 16); and those which may be fabricated with formed sheet metal or standard extruded shapes.

The design shown in Fig. 14 is generally used in the construction of box-like shapes. It has the advantage of protecting all of the panel edges from any tendency to peel, and in the absence of an edge member on the panels, may utilize semihollow aluminum or steel rivets (of proper grip length), with no distortion to the panel. Where a panel edge member is present, such a configuration may utilize bolts or

(Turn to page 72, please)




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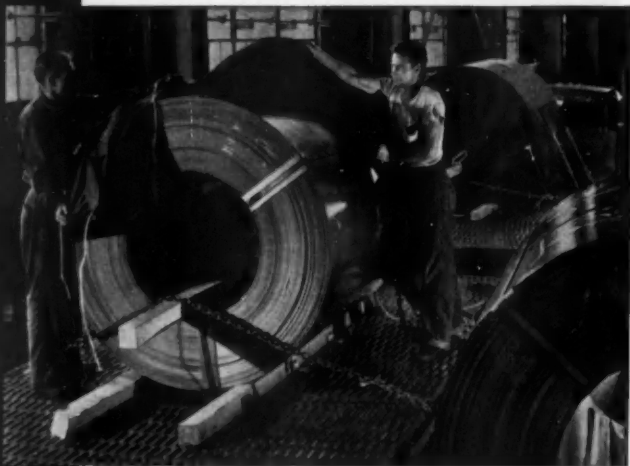
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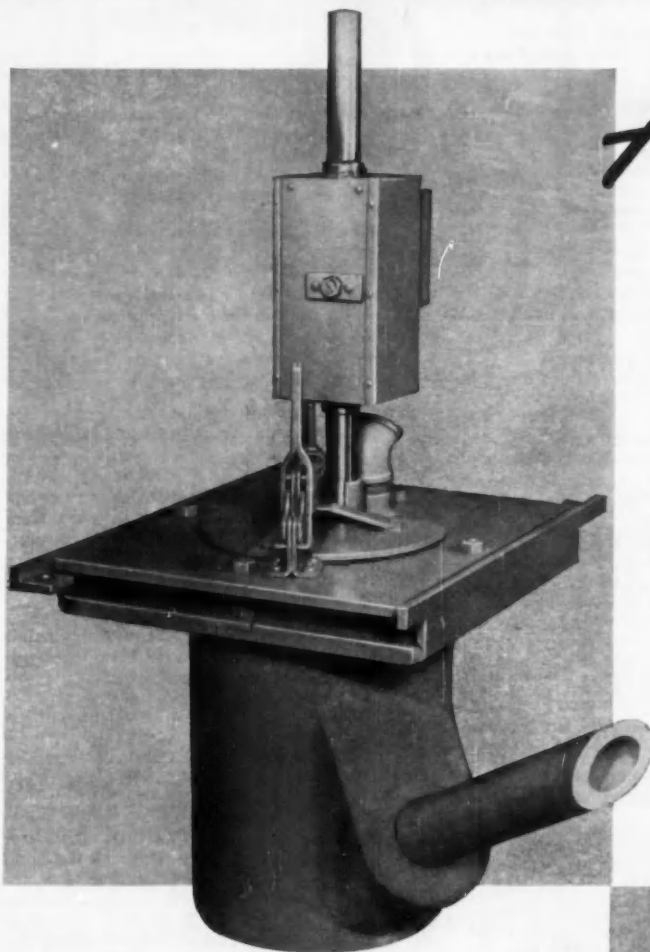
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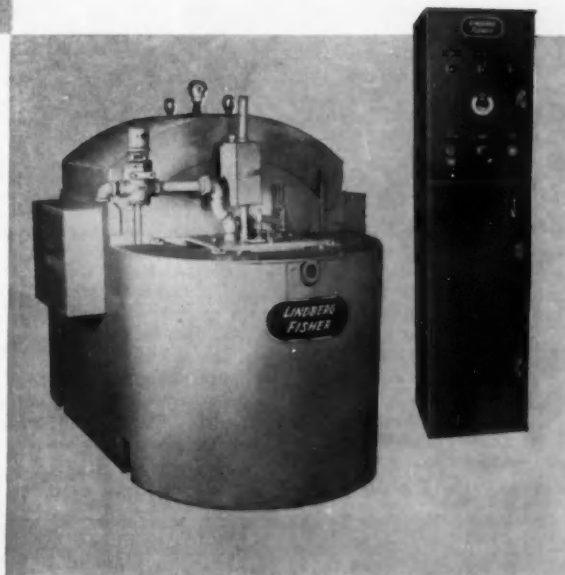
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- Composed of special refractory materials so arranged that ladled metal cannot come in contact with any metal.

At the right, "Little Joe" is shown installed in a Lindberg-Fisher electric resistance aluminum holding furnace. With it is the panel cubicle and controls which is supplied completely assembled and wired. For complete information on the Autoladle get in touch with your nearest Lindberg Field Representative (See your classified phone book) or write us direct.



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"The principal advantage of Tru-Lay Push-Pulls in our application is that they permit flexibility in locating the control valve in relation to the operator's position."

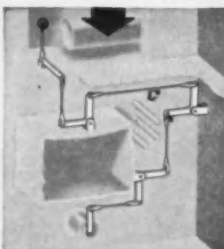
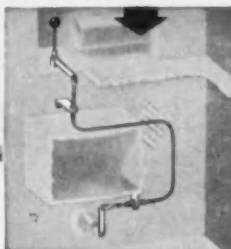
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"Tru-Lay Push-Pulls are easier and less expensive to install than linkages for remote control of power take-off."

TRU-LAY PUSH-PULLS are "Solid as a rod but Flexible as a wire rope." This flexibility makes it possible to snake around obstructions ... permits the ideal arrangement of all elements of remote controls.

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Construction Equipment and Farm Implements provide good examples of the wide-spread use of these accurate, simple and dependable Push-Pulls. On Power Shovels, Winches, Graders, Road Oilers, Dump Trucks, Snow Plows, Engine-driven Pumps, Crushers, Tractors, Combines, Corn Pickers, Corn Row Sprayers, Corn Detasslers, Orchard Sprayers, Power-driven Tree Trimmers, Tobacco Picking Machines and others ...

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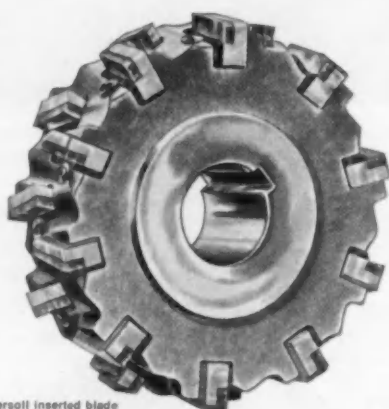
Plain carbon steel valve with aluminized face after exaggerated test of 16 hours in air atmosphere at 2000° F. Note the gross oxidation of the non-aluminized stem area and the excellent condition of the aluminized seat-face and margin.

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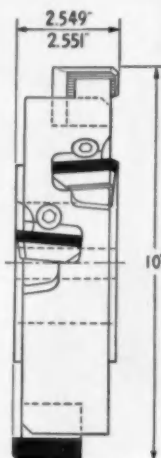
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Ingersoll inserted blade
staggered tooth channeling
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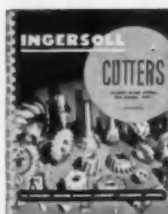


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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Continued from Page 39

chrome molybdenum steel combines light weight with high strength and torsional rigidity, and makes possible the use of the magnesium alloy body, which it cradles. Rear suspension of the Corvette SS is unusual for an American car. It utilizes the DeDion principle in which the differential is affixed rigidly to the frame. A tubular member connects the rear wheels. Drive from the differential is through stub axle shafts having universal joints at both ends. Control of suspension movement is through four arms linking the frame to the DeDion axle tube. Attachment at frame end is in rubber, and through ball joints at the DeDion tube end. Advantages of the DeDion mounting, Chevrolet says, are a low unsprung weight, more accurate control of unsprung weight, and freedom from "windup" wheel loading from engine torque.

Brake design of the car is interesting. Two separate hydraulic systems, vacuum assisted, are provided, one each for front and rear, but controlled from a single pedal. Thus if one system fails, braking powered on at least two wheels is available.

Mounting of rear brakes inboard next to the differential housing puts all brake reaction forces through the frame rather than the articulating rear suspension members. It also undoubtedly adds to cooling efficiency by

providing better air flow around the drums, which have a cast aluminum outer rim.

Body design features include a plastic windscreen to shield the front and sides of the cockpit. A roll bar, rigidly attached to the frame, is enclosed in the headrest housing. The two-piece body is hinged front and rear in draw-bridge fashion, so that either section can be raised for easy accessibility to engine or differential. Break point is just forward of the cowl.

CORVETTE SS General Specifications

Wheelbase: 92 in.
Tread: 51.5 in. (front and rear)
Dry Weight: 1850 lb.
Body: Magnesium, hinged at cowl.
Frame: Tubular truss.
Engine: V-8 type, 3.875 in. bore, 3.0 in. stroke, 283 cu in. displ; with Chevrolet fuel injection system.
Radiator: Aluminum; engine oil heat exchanger in bottom.
Fuel System: 43-gal tank; two electric pumps.
Transmission: Four-speed, all forward gears synchronized.
Ratios—(1st) 1.87:1
(2nd) 1.54:1
(3rd) 1.22:1
(4th) 1:1
(Rev) 1.87:1
Front Suspension: Independent coil spring type, with variable-rate springs; stabilizer bar of link type.
Rear Suspension: DeDion type with four articulating arms and coil springs.
Rear Axle: DeDion type, with quick-change gears.
Steering: Gear ratio 12:1; overall ratio 12:1.
Wheels: Cast magnesium; with knock-off hubs.
Tires, Super Sports: front—6.50/6.70-15, rear—7.10/7.60-15; all 6-ply.

Allison Gets \$15 Million Turboprop Engine Order

General Motors shared the largest slice of orders placed with industry last month (March) by the Air Materiel Command and the Ordnance Tank-Automotive Command. Largest order, valued at \$15.1 million, went to GM's Allison Div. in Indianapolis for production of T-56 turboprop engines for the C-130 transport plane.

Three separate contracts totaling more than \$2.6 million were given to Chevrolet by OT-AC for light and heavy trucks and 30-passenger buses for the Army, Navy, and Air Force. GMC Truck & Coach Div. got a \$56,111 order for buses for the Air Force. Orders totaling \$501,812 and \$60,788, respectively, were given to Ford and International Harvester for trucks for the Navy.

Record Sales and Revenues Rung Up by Sharon in 1956

Sharon Steel Corp. has reported record sales and revenues of \$180,044,408 for the year 1956. Net operating income, adversely affected by the 35-day steel strike, amounted to \$6,905,530, compared to \$7,987,622 in 1955.

In addition, the company had non-recurring net income of \$6,411,709 from the sale of properties and investment securities. Total net income including special items was \$13,317,239.

SOUTH ATLANTIC REGION ALONE SHOWS INCREASE IN JANUARY OVER DECEMBER

Regional Sales of New Passenger Cars

Zone	Region				Per Cent Change	
		January 1957	December 1956	January 1956	January over December	January over January, 1956
1	New England	19,566	22,721	22,134	-13.99	-11.60
2	Middle Atlantic	64,894	86,085	80,863	-26.31	+ 8.41
3	South Atlantic	63,373	61,802	62,246	+ 2.54	+ 1.81
4	East North Central	113,295	133,730	115,104	-15.28	- 1.57
5	East South Central	20,945	32,817	21,109	-36.18	- 78
6	West South Central	38,687	44,028	37,246	-12.13	+ 3.87
7	Mountain	47,242	51,350	39,600	- 6.07	+19.30
8	Pacific	13,800	29,216	13,558	-31.74	+ 1.78
9	Pacific	55,516	59,296	60,788	- 6.37	- 6.67
Total—United States		437,320	514,061	431,648	-14.93	+ 1.31

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn.

Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Cal., Ore., Wash.

NEW

PRODUCTION and PLANT

EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



Avey machine drills, bores and spotfaces the flanges and periphery of a jet engine part

Machine Performs Operations on Jet Engine Part

THE machine illustrated was recently shipped to a West Coast aircraft plant for drilling, boring, and spotfacing the flanges and periphery of a jet engine component.

The two Aveydraulic units mounted horizontally have 12-in. ram travel. The third unit, mounted vertically, has 16-in. ram travel and a six-speed gear box with a speed range of 150 to 1800 rpm. The vertical column has an in and out traverse of 20 in., and moves to a minimum of 15 in. and a

maximum bolt circle of 55 in.

The 60-in. Electrode table is equipped with a master index ring with two rows of bushings, 96 and 49 respectively. Two-shot bolt assemblies, coupled with a programming device, permit programming of the three heads to the indexing of the table.

All units and table are pushbutton-operated. The machine was built to JIC standards. *The Avey Drilling Machine Co.*

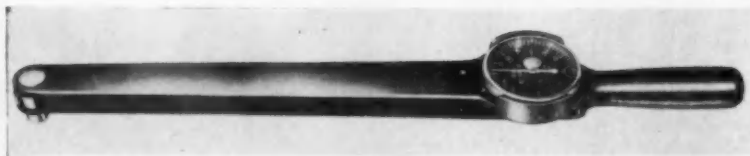
Circle 30 on postcard for more data

Rigid Frame Torque Wrench

A RIGID FRAME torque wrench, featuring a large dial for easy reading of torque and a removable and reversible plug, has been announced. It is available in ranges of 0 to 300 lb-in., 0 to 2400 lb-in., 0 to 25 lb-ft, and 0 to 200 lb-ft. This fully enclosed

wrench is designed so that pressure may be applied anywhere on the wrench; a handle extension can be used if desired. All models in the series have hand-set maximum torque indicator on dial. *Apco Mossberg Co.*

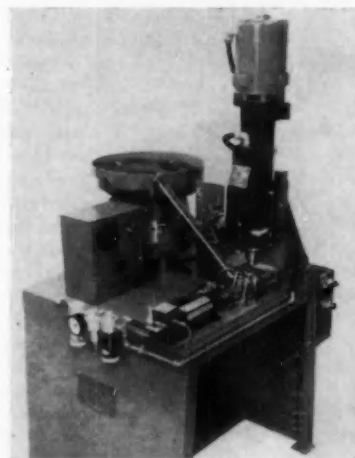
Circle 31 on postcard for more data



Apco rigid frame torque wrench is available in four ranges

Tapping Machine

ANNOUNCEMENT has been made of an automatic tapping machine for small parts. As illustrated, it consists of a vertical tapping unit, a vibratory feeder, a gravity track, an escapement, a work feeder which positions and clamps the part in the tapping fixture, and an ejector me-



Automatic tapping machine processes over 1500 pieces per hour

chanism which discharges the part into a chute.

Production of the machine is said to be over 1500 pieces per hour. The manufacturer also states that the basic design may be modified, on special order, to adapt the machine to automatic drilling or assembling. *Automation Development Corp.*

Circle 32 on postcard for more data

Dynamic Balancer

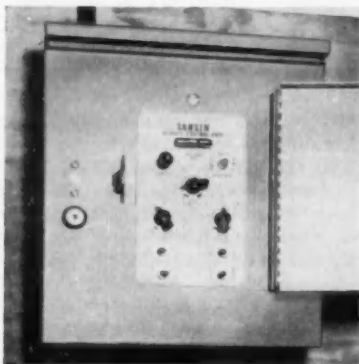
DESIGNED for precision balancing of miniature gyros, a new dynamic balancer will reportedly determine unbalance vibrations as small as one-quarter of one millionth of an inch. Named Model K, its ultra-sensitive characteristic is said to offer a solution to the problem of production-balancing miniature gyros used in missiles. *Micro Balancing, Inc.*

Circle 33 on postcard for more data

Unloader Control

DESIGNED for use with both existing and new Iron Hand installations, an electronic remote control system recently announced provides ground-level adjustments to automatic press unloaders. With the new unit, operators can adjust unloaders by turning calibrated dials instead of using the slower and less precise methods of adjusting pneumatic time-delay needle valves, speed control and sequence valves, and shut-off valves mounted on the Iron Hand itself, or on the press.

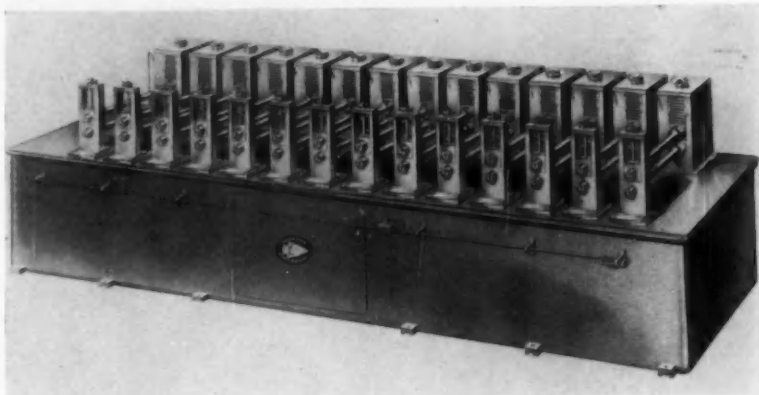
It consists of a control panel, containing three electronic tube timers, which can be mounted on the press column or other convenient location,



Control panel of Sahlin's new electronic remote control system for adjusting automatic press unloaders

and a cable running to the Iron Hand. The Iron Hand itself contains two operating valves and a motorized flow control valve. Upon receiving an impulse from the press limit switch, the Iron Hand begins its cycle which is controlled by the electronic remote control panel. By adjusting panel dial instructions are transmitted to the unloader. Nine different adjustments are possible including main cylinder speed control, delay between jaw gripping panel and lifting action, jaw release point, arm stroke and over-travel, arm return-stroke delay, independent arm or jaw operation, and Iron Hand cycling independent of the press. Time delay increments from zero to six seconds are provided.

The Iron Hand responds instantly to these settings, or changes in settings, thereby speeding up adjustments which may be required during production, and saving time on die changeover. Adjustments can be performed while the Iron Hand is operating. Finally, a memory chart is



The 14-head Mohawk rolling mill illustrated is one of a line of universal models varying from six heads up and featuring arbor interchangeability

Rolling Mill Features Interchangeable Arbors

INTERCHANGEABLE arbors are featured in the introduction of a new universal metal-forming rolling mill. By removing the out-board and two screws on each arbor, the arbor can be changed from one rolling form to another, or to one of correct size to provide rigidity for the particular form to be rolled. These sizes vary from one up to three inches, as needed. Each arbor can be removed in about five minutes, and the time for a 14-head mill, for example, is about 140 min. It is pointed out by the company that through the use of the right-size arbor for rigidity, a smoother, cleaner, sharper, wave-free form can be rolled, and that the interchangeability feature facilitates the rolling of forms to closer limits. Also that rapid arbor interchangeability

adds to the machine's versatility.

Another stated feature of the machine is a variable speed drive and electric control for traveling the strip steel at speeds for both quality forming and maximum production. The mill is powered by an electric motor which supplies driving force through a magnetic clutch and brake to gear boxes, each of which is equipped with herringbone gears. Thence the power is transmitted to the station, with each arbor operated by a spiral worm gear, which in turn operates a bevel meter gear. Each arbor rolls on Timken roller bearings.

These universal rolling mills range from six heads up for flexibility in meeting individual needs. *Mohawk Metal Forming & Tool Corp.*

Circle 35 on postcard for more data

provided to record dial settings for individual die setups, a design feature that eliminates guesswork and further speeds changeovers. For instance, once the settings are recorded for a hood or fender line, adjustments to automatic unloaders during a change can be made in a matter of seconds. *Sahlin Engineering Co., Inc.*

Circle 34 on postcard for more data

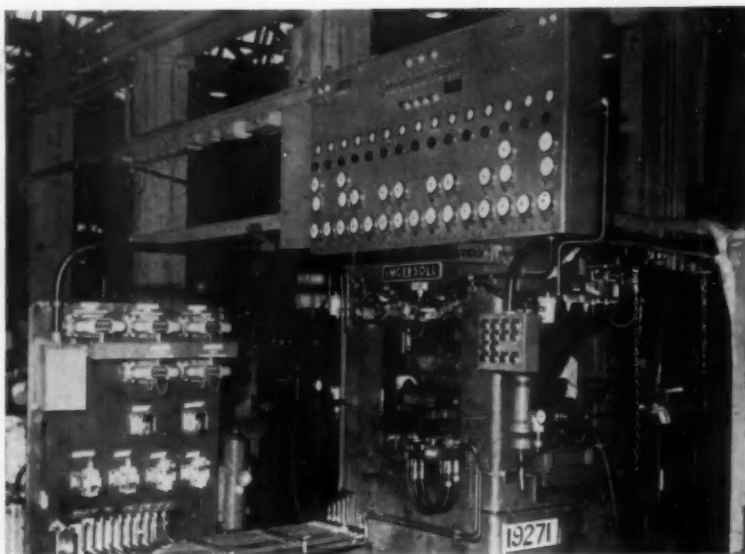
Backstop Clutches

LARGE-BORE over-running clutches have been introduced in an expanded line of six sizes that incorporate added refinements. Known as the Models FS-1100, FS-1150, FS-1200, FS-1250, FS-1300 and FS-1400, the sealed double ball bearing clutches

are said to combine compact size and lighter weight with greatly increased torque capacity. They replace the previous four models. Designed primarily for backstop purposes, these units are normally installed on the headshafts of large conveyor systems. Other applications recommended by the company are as backstops for elevators and as dual drives for standby power units and differential-speed drives.

The new models are now available in maximum-bore sizes from 6 to 12 in., with torque capacities from 18,500 to 136,500 lb.-ft. All have sprags individually energized by pairs of springs for reliability, ball-bearing construction for smooth operation and long life, mechanical seals to prevent entry of abrasive material, and grease lubrication. *Formsprag Co.*

Circle 36 on postcard for more data



Combination automatic gage and transfer machine makes 25 measurements on cylinder blocks, at the rate of 95 per hour

Gaging Machine Checks Engine Cylinder Blocks

ONE of the elements in a new engine block transfer line is a combination automatic gage and transfer machine for checking crankshaft and camshaft bores in the cylinder block. It not only checks machining operations, but also checks the result of an automatic assembly operation. The air-electric gaging equipment, in inspecting the blocks, marks the acceptable ones to show their relative

size. Blocks that are not acceptable are not allowed to continue to the next operation.

A total of 20 ID's—two each in five crankshaft bores and two each in five camshaft bores—are measured. In addition, the alignment of holes in five bearing liners are checked for automatic assembly alignment with the oil holes in the camshaft bores. All of these conditions are inspected

simultaneously. The measuring is done with 10 air plugs which are automatically inserted into the bores. Each of the plugs for the crankshaft bores takes two diameter measurements, i.e. at opposite ends of the bores and at right angles. The plugs for the camshaft bores make similar diameter measurements, plus the oil hole location check.

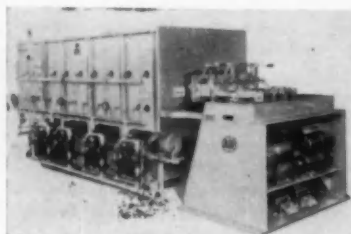
Signal lights give a visual indication of the condition of the engine block. If all 20 diameters and the alignment of the oil holes are within tolerance, a green light indicates that the part is good. A stamping unit then stamps a plus or minus sign on each end of the block to indicate whether the No. 1 crankshaft and the No. 5 crankshaft bores are above or below the nominal size within the tolerance limits. If any one dimension is outside tolerance limits, the block is shunted out of the transfer line unstamped.

This combination automatic gage and transfer machine is capable of handling 95 engine blocks an hour. The short time necessary to make all 25 measurements does not slow down the production line, but allows the parts to move along at their normal speed. The handling, positioning, and control portion of the machine was designed and made by *The Ingersoll Milling Machine Co.*, while the gaging and classifying equipment was supplied by *Federal Products Corp.*

Circle 37 on postcard for more data

Twin-Hearth Furnace

TWIN HEARTHS for "double production" have been incorporated in the AGF Model 242 shaker furnace recently presented. Two parallel sealed hearths are mounted in this new type



AGF Model 242 shaker furnace has two hearths for added production

of furnace to double the heat treating production of the same work, or to heat treat two different types of parts which require the same atmosphere for processing at the same or different time cycles.

Automatically operated, these twin hearths are each intended to process up to 800 lb. of work per hour. The complete furnace is so constructed as to be adaptable to production line installation. Each hearth is individually controlled for operating speed, and the work advances automatically by the regularly interrupted reciprocating movement that carries the work through the controlled atmosphere. *American Gas Furnace Co.*

Circle 38 on postcard for more data

Titanium Heating Unit

FOR high heat-concentration needs in titanium forming dies, a new electric heating unit is being offered that is said to display a higher potential in watts densities, operating temperatures, and cartridge life. The company points out there are titanium alloys that are formed at 1300 F and some even as high as 1700 F. And

that the demand for heat has been increasing, with a call for watts densities on the heating units varying from as low as 28 w/sq in. to as much as 145 w/sq in. The new unit, named *Firerod*, is indicated as being capable of meeting these requirements.

One application cited is that of a manufacturer who is producing jet engine cowlings, engine cowl flaps and other parts from titanium sheets, as well as small brackets and rods. Using *Firerod* in each of the forming dies, and operating at some 1400 F, it is possible to reach and maintain the necessary operating temperature with over 100 w/sq in. Mention is also made that a test unit, measuring ½-in. OD by 2¼-in. long and rated at 115-v, 250-w, giving it a watts density of 90 w/sq in., has been operated in open air for periods up to 720 continuous hours, at a sheath temperature of 1800 F. *Watlow Electric Manufacturing Co.*

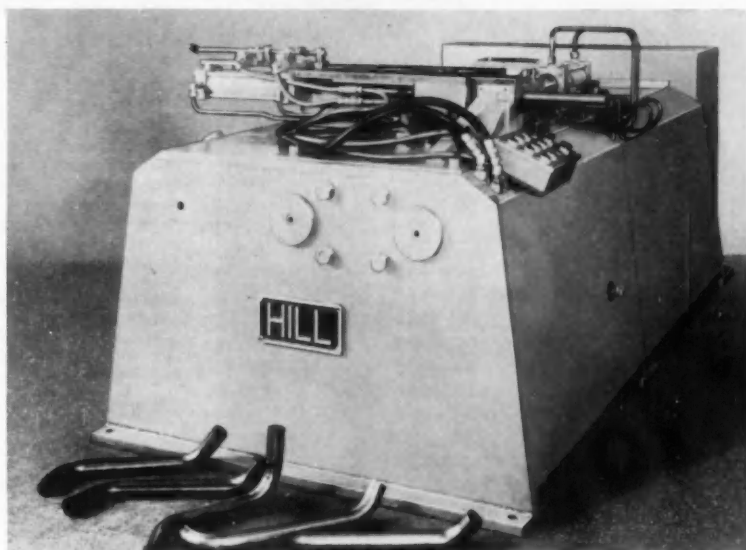
Circle 39 on postcard for more data

Press Bender for Accurate Bend Relationships

To provide a high-speed process for making tubular parts in which two or more bends of varying angles must be in accurate relationship, a horizontal press-type bending machine has been introduced. One end of the tubular part is clamped while the bend is produced on the other end by a hydraulic-powered press ram and wiper die assembly. This method is said to assure accuracy of bend relationships because the tubing is held stationary for each bending position in fixtured radial location to the previously-produced bend.

The bending operation can be performed with or without a mandrel, depending upon the particular tubing requirements. The wiper die and mandrel assembly move with the tubing as it is bent, to avoid die marks and wrinkles in the bent parts. Travel of the press ram and wiper die assembly can be controlled in sequence to produce bends of different angles in a single part in an automatic bending cycle.

In operation, the tubular part is placed in the die and the first bend cycle button is pressed. The die block is closed by a 4-in. diam hydraulic cylinder, clamping the part for the bending operation. A bending mandrel is advanced into the part by a 2½-in. diam hydraulic cylinder and the bend is pressed-in by an 8-in. diam ram hydraulic cylinder. During the bending operation, the wiper die mandrel and its control cylinder, which are mounted on a wing unit, follow the bend under the control of a 3½-in.



Hill press bender produces two different-angle bends with accurate relationship, in two-inch diameter welded steel V-8 engine exhaust manifold crossovers. Net production rate is 650 pieces per hour

diam hydraulic cylinder. At the completion of the bend, the mandrel retracts, the ram returns to start position, and the tubing is released from the die. The next bend in the part is made by locating it for clamping in the die from the previously-produced bend and pressing the cycle button for the second bending cycle.

The press bender illustrated produces two bends with different bend angles in accurate relationship, in two-inch diameter welded steel V-8

engine exhaust manifold crossovers, at a net production rate of 650 pieces per hour. A 1000-psi hydraulic system powered by a 30-hp motor and a 40-gpm pump operates the ram, mandrel and wiping die cylinders. The die clamping system is powered by a separate 2000-psi hydraulic system powered by a 5-hp motor and a 3-gpm pump. The machine occupies a floor space about 5-ft by 8-ft and is 45-in. high. *Walter P. Hill, Inc.*

Circle 40 on postcard for more data

Bench Grinder

THE addition of the Model DBA-O bench grinder to a line of abrasive belt machines, has been announced. This compact grinder has a six-inch diameter, two-inch wide contact wheel that is direct-driven by 0.6 hp motor to develop a speed of 5100 sfm for stock removal applications such as grinding, polishing and deburring. Standard abrasive belt size is 2 in. wide by 45 in. long. The idler arm incorporates belt tracking and tensioning mechanisms and can be rotated 360 deg around the spindle to provide operation in any position. Weight of the grinder is 40 lb.

For squaring, chamfering and beveling, a platen attachment is available at extra cost. This platen is attached directly to the idler arm and maintains its relationship to the abra-

sive belt without adjustment regardless of the position of the arm. *Curtis Machine Div., The Carborundum Co.*

Circle 41 on postcard for more data



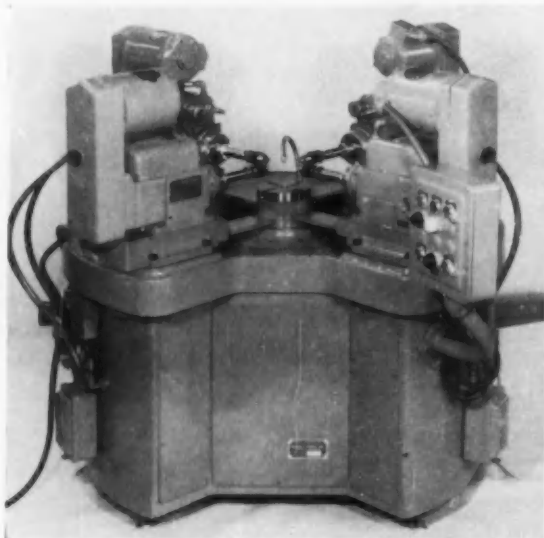
Curtis Model DBA-O abrasive-belt bench grinder

Water Treatment

DEVELOPED for use in water wash spray booths, a liquid treatment material has been introduced to increase efficiency by protecting the equipment and facilitating reclaiming of overspray. Called Mogul M-55, it operates on the principle of keeping overspray paint particles separated, enveloping them in a protective film to make them float. In addition, a rust-inhibiting formulation checks rust and scale formation in lines, as well as in headers, nozzles and strainers.

The manufacturer states it is non-caustic and safe to handle. Liquid dosages are merely mixed with equal amounts of water and poured into the booth pan. *North American Mogul Products Co.*

Circle 42 on postcard for more data



Gilman automatic cross-drilling machine has four horizontal drill heads. Operating sequence of the heads is controlled by a four-position rotary drum switch. The hydraulic-fed drill heads can be positioned anywhere on an arc of 270 deg around the workpiece.

Machine with Four Horizontal Drill Heads

MULTIPLE operations can be performed with a recently built automatic cross-drilling machine having four horizontally-mounted drill heads located on a common plane and pivoting around the axis of the workpiece through an arc of 270 deg. A four-position rotary drum switch con-

trols the sequence of operation of the heads; complete operating cycles can be set up or changed rapidly, as required. Control of the four heads is interlocked to prevent drill interference. Feed movements are hydraulic-powered.

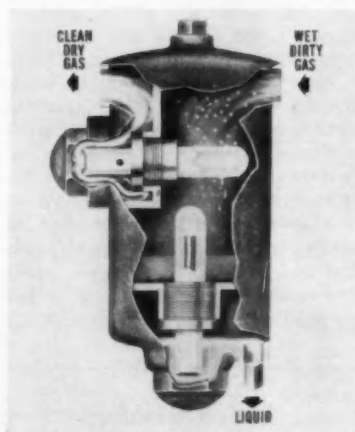
A broad range of multiple opera-

tions can be handled at high production rates. For example, heads operate in a preset sequence for cross-drilling; although they can operate simultaneously when the holes do not intersect. Through-drilling can be performed by one head, followed by reaming with an opposed head. In the same cycle, the workpiece can then index 90 deg for counterboring and chamfering with the other two opposed heads. Russell T. Gilman, Inc.

Circle 43 on postcard for more data

Liquid-Gas Separator

THE Liqui-Jector, a liquid-gas separation device for removal of entrained liquids and solids from air, gas and steam systems, is now available in 12 standard sizes. It has previously been furnished as specially-designed units, custom-built to meet specific conditions. Providing clean dry air for operating pneumatic equipment and control and recording

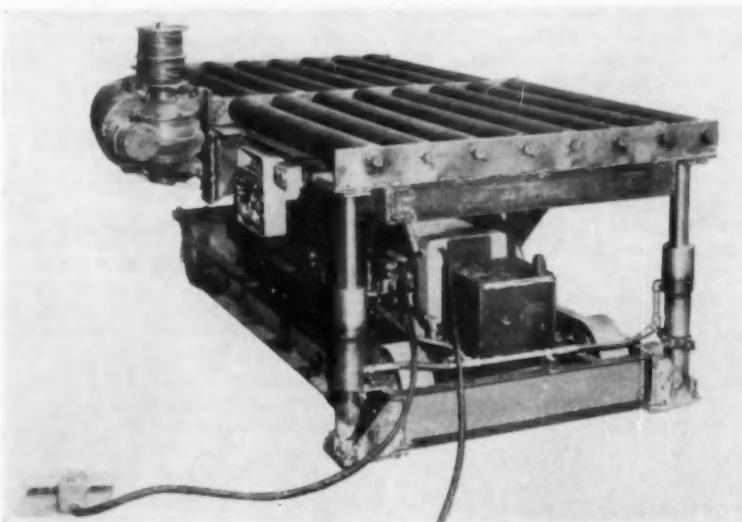


Cutaway of model A-1 Liqui-Jector

instruments, the device operates by phase separation, trapping solids, and passing liquid in one direction and gas in another, without interrupting the flow through the line. In addition to air and steam, such gases as hydrogen, oxygen, nitrogen, argon, propane, butane, and generated atmospheres can be cleaned and dried.

This unit is available in three standard models: Series A for volumes up to 100 scfm gas at 150 psig; Series B for volumes up to 7000 scfm gas at 200 psig; and Series C for conditions where unusually large volumes of condensate are encountered. Selas Corp. of America.

Circle 45 on postcard for more data



Winch-Equipped Lift Platform for Heavy Dies

Developed recently, this means for handling heavy dies consists of a hydraulic lift table, 48 by 96 in., with two sets of conveyor rollers, built for 20,000 lb lifting capacity—and a motor-driven winch. The platform is raised or lowered to press height through a two-way foot pedal control operating a hydraulic pump and motor. Loading or unloading of the die is done by attaching the winch hook and pushing a button. Steel wheels and swivel front casters, plus tow-bar, permit movement and positioning of the table. Lowered height is 26 in., raised 42 in. (West Bend Equipment Corp.)

Circle 44 on postcard for more data

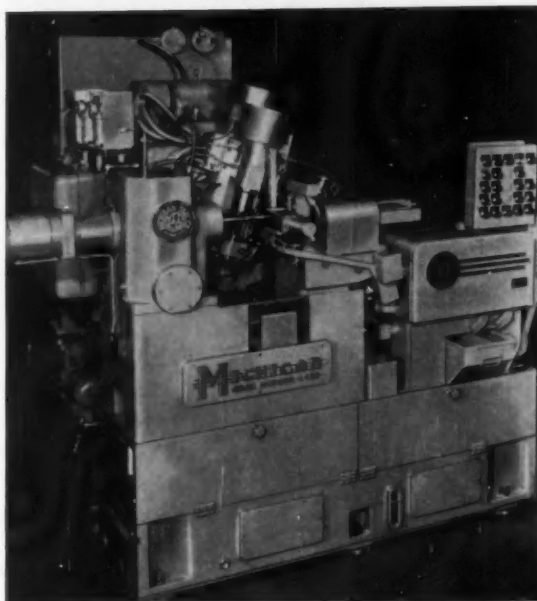
Small-Gear Hobber Uses Common Base for Tandem Setup

DEVELOPED to meet requirements for a completely automatic hobbing line for high-volume production of a single gear, the new Model 1433 high-speed hobber, using a common sub-base, can be set up in tandem or in unlimited series with automatic through-feeding and removal of parts. Gear washers and gear classifiers can be integrated into the machine units. Automatic size control is also provided.

The horizontal, single-spindle machine will hob up to 12-pitch spur or helical gears. Maximum center distance, hob arbor to work spindle, is 3¼ in.; maximum crossfeed stroke of the hob is 4 in.; and the machine can hob either right- or left-hand helix angles up to 30 deg.

High-production features include "plunge" cutter feed and an automatic expansion arbor for workholding. In operation, the hob is plunge fed into the work, eliminating the approach feed, and is then fed across the work, the stroke of which is completely adjustable. Plunge infeed and crossfeed are powered by airhydraulic cylinders, and feed rates are infinitely variable. Setup is simplified as the gear helix angle is obtained by a simple setting of the hob spindle head. Work rotation is by a preset timed relationship with the hob, controlled by change gears. The entire hobbing cycle is automatic. Hobs revolve at variably selected speeds up to 500 rpm. Either conventional or climb hobbing may be used with single, double or triple thread hobs. The hob head may be adjusted for hob thread angle, gear helix angle, and automatic hob position shift.

Michigan Tool Model 1433 high-speed small-gear hobber can be set up in tandem for an automatic hobbing line. Design provides automatic through-feeding and removal of parts. The universal horizontal single-spindle unit will hob both spur and helical gears.



Each tandem base is so designed that another tandem base can readily be joined to either side, with O-ring seals between the openings, so that all sub-bases joined side by side are, in effect, one integral base. As many tandem hobbars as are required can therefore be joined together to form a continuous production line. Shut-down of one machine for tool changeover, or for any other purpose, does not affect the operation of the other hobbing machines. Master panel and electrical connections are mounted in the sub-base, so that even removal of the hobbing unit can be done without af-

fecting "in-line" production. All machine services are also self-contained in the sub-base, including air or hydraulic pressure lines for operation of feeds, coolant system, conveyor for removing chips, used-coolant return lines, conveyor lines to remove finished parts, and lubrication system. Lubrication is automatic oil-air mist. This can be provided individually or as a central lubrication system for tandem machines. The coolant supply can also be furnished as a machine unit, or as a central system for machines in tandem. *Michigan Tool Co.*

Circle 46 on postcard for more data

Car Loads and Unloads Coils from Reels

RECENTLY developed, a heavy-duty coil car is said to give a fast, inexpensive and safe method for loading coils onto pay-off reels and unloading coiling reels, without the use of pits. Coils are carried in a steel cradle supported in a rigid L-shaped frame which is raised and lowered hydraulically. The car, provided with through axles, roller bearings, and flanged wheels, operates on two rails set at floor level, thus eliminating pit complications. Powered electrically, it is loaded with a coil from a coil ramp, lift truck or crane, often in an adjoining bay, and is then moved across the tracks into position near the reel for the reloading operation.

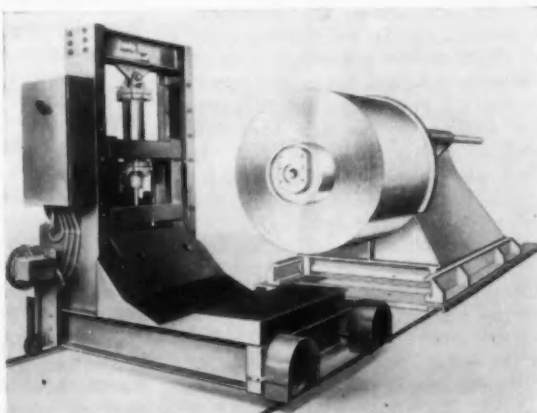
Three standard sizes, for coils from 7500 to 20,000 lb, are available. Sev-

eral variations to meet unusual requirements are also obtainable. *The*

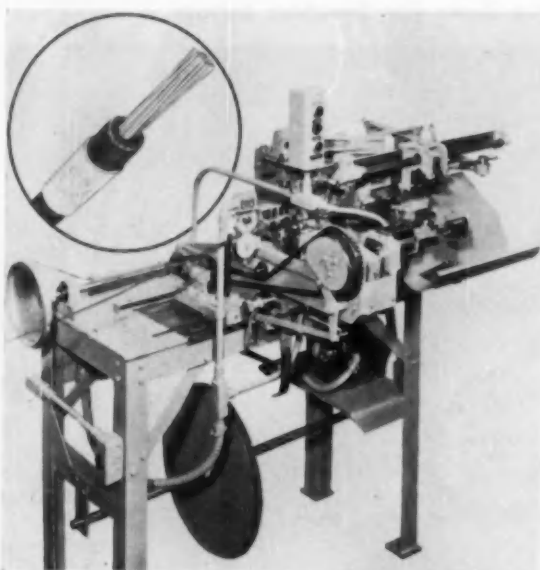
Herr Equipment Corp.

Circle 47 on postcard for more data

Herr heavy-duty coil car loads and unloads coils from reels at floor level. Three standard sizes for handling coils from 7500 to 20,000 lb, are available.



NEW PRODUCTION and PLANT EQUIPMENT



Artos Model SPA combination wire stripping and metal tagging machine automatically measures, cuts, strips wire leads and attaches an aluminum identifying tag at the rate of 3000 pieces per hour

Machine Cuts, Strips and Tags Wire Leads

COMBINING tagging and stripping, a machine has been announced that automatically measures, cuts, strips wire leads and also attaches an aluminum identifying tag at the rate of 3000 pieces per hour. It is claimed to offer a definite advantage to manufacturers where wire leads have to be permanently identified and where tags made of tape will not stand up during further processing of the wire.

Identified as the Model SPA, the machine is adjustable to cut wire to

predetermined lengths of from 4 to 194 in. Each tag is marked and cut from a continuous roll of blank aluminum. As the machine operates, it automatically attaches the metal identifying tag anywhere along the length of the wire at each feeding stroke, the maximum distance apart being 15 in. The attaching unit is designed to take interchangeable stamps for different markings. *Artos Engineering Co.*

Circle 48 on postcard for more data

Forming Lubricants

TWO dispersions of glass in isopropyl alcohol have been developed for high-temperature metalworking lubrication. These dispersions are applied to the work at room temperature, forming a dry continuous film which inhibits oxidation and surface contamination during the heating cycle. At a temperature below that at which the work is forged, the glass fuses to the surface, providing a hydrodynamic film during the forming operation. Designated Nos. 239 and 240, the glass dispersions are applicable for giving a protective and lubricating coating in the forging of special alloy steels, titanium and other metals subject to oxidation or gas absorption at elevated temperatures during preheating and forming.

Dispersions 239 and 240 differ only in the composition of the glass used in their preparation. No. 239 contains a glass with a fusion temperature of

about 1100 F, while the glass in No. 240 has a fusion point of about 1300 F. *Acheson Colloids Co.*

Circle 49 on postcard for more data

Tool and Die Steels

INTRODUCTION was recently made of a complete new line of more than 1300 standard stock sizes of oil and air-hardening, flat-ground die steels suited for a variety of tool and die applications. Called Nucut Die Steels, they feature a surface finish of 25 to 35 microinches, easy machinability, and wide hardening ranges. Surfaces, ready for immediate layout, are protected in shipment and storage by special packaging, which includes heat-treating instructions.

The oil-hardening type is a high-grade molybdenum alloy tool steel. Hardness of 64 to 65 Rc may be achieved by hardening in the range

of 1450 to 1540 F. It may be used for such applications as dies, jigs, punches, templates, gages, and small tools.

The air-hardening type is a five per cent chrome alloy. Tools made from this steel, which provides wear resistance, are said to be particularly suited to punching silicon or stainless steels, Monel and other tough metals, or for long production runs where the tool must be kept in service without frequent sharpening. Hardness of 63 to 65 Rc is achieved within a temperature range of 1700 to 1800 F.

The oil-hardening type is available in 18 and 36-in. lengths, in widths from 1/64 to 14-in., and in a wide variety of stock sizes. The air-hardening type comes in 36-in. lengths in a range of widths and thicknesses, including squares. *Heller Tool Co.*

Circle 50 on postcard for more data

Pneumatic Crimper

DESIGNED primarily for crimping solderless electric terminals, a pneumatic crimper called the Airlox also lends itself to staking applications and some types of press operations. Movable jaw stroke is adjustable from 0 to 1/2-in. max travel. This allows a fixed depth of indentation on the work, depending on the die characteristics and the capacity of the crimper. Developed squeeze on work is 50 times air line pressure. Weight of the unit is about 70 lb; and overall dimensions approximately 12 in. high by 8 1/2 in. wide by 11 long.

The crimper is furnished complete with foot valve, quick exhaust valve, exhaust muffler, four feet of air hose, air line lubricator, and regulator with gage. *Production Devices Inc.*

Circle 51 on postcard for more data



Airlox pneumatic crimper for solderless electric terminals

Measuring Machines

MACHINES for the precise measurement of lengths and diameters beyond the size of the longest practical gage block, have been introduced. Called Watts length measuring machines, they are said to provide a permanent and reliable universal standard to which gages and components can be set.

Type A, available for 80 to 120-in. length, consists of a measuring head which contains a four-inch high precision glass scale with projector reading directly to 0.00005-in. and repeating to a setting accuracy of 0.00001-in. A high power microscope sets the instrument's measuring head to the master scale's four-inch graduations. This scale is housed in a protecting channel at the center of the machine and is therefore directly below the work to be measured. The bed of the machine contains optical compensators so that any graduation tolerance in the master scale can be fully compensated.

Type B, for measuring to 0.0001-in. at 30 ft., employs a sectional bed and a precision divided steel master tape under constant tension. Otherwise it is similar in design to the Type A. Work supports, coarse external scale and support plates complete the equipment. *Engis Equipment Co.*

Circle 52 on postcard for more data

Pneumatic Tapper

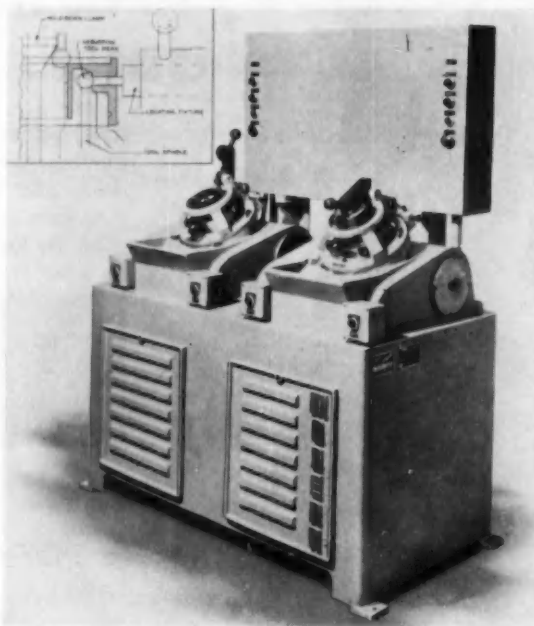
THE introduction of a new automatic, high-speed, air-actuated tapping head with torque control, has



Commander pneumatic tapping head

been announced. Called the Pneumatic tapper by its maker, it may be mounted on any drill press. Auto-

Special Burr - Master machine for functionally back - chamfering 20 hidden holes in an automatic transmission piston by the method shown in inset. It uses a rotary burr tool and automatic index of the part to turn out 200 parts per hour from two stations.



Two-Station Machine Chamfers Hidden Holes

ANNOUNCEMENT has been made of a special two-station Burr-Master that was designed for the functional chamfering of hidden holes in an automotive part. Workholding fixtures are custom-tailored, but the machining concept itself is felt by the company to be applicable to similar automotive and aircraft parts.

As set up for an automotive parts producer, the machine countersinks 20 blind holes on the internal diameter of a stator-blade piston for an automatic transmission. Functional chamfering was necessary to permit clearance for operation of a gate-like mechanical valve in each hole. Parts are semi-automatically positioned on the work spindle and wedged, then manually clamped. Central and radial locations of the workpiece is taken from pre-drilled holes. The rotary burr tool is brought into contact at 90 deg to

the work. The piece is automatically indexed for the complete work cycle. Production rate for this particular application from both stations is 200 parts an hour.

An electric clutch stops the machine with both cutters withdrawn, for loading and unloading. Separate motors and controls are supplied for each work station for flexibility in operation. The machine is equipped with upper and lower cam-actuated rocker tool assemblies, and intermittent indexing assembly with provision for radial adjustment of pilot gear for work location. All electrical circuits are designed to JIC standards. Two one-horsepower, 1200-rpm, 220/440-v a-c motors are used, one for each station. Floor area required is 37 by 57 in. *Modern Industrial Engineering Co.*

Circle 53 on postcard for more data

matic control of approach, tapping, reversal and withdrawal permits high-speed automatic or semi-automatic tapping. Rate of spindle approach and tapping depth are adjustable.

The tapper repeats the preset cycle each time the foot, fixture or hand switch is actuated. A cycle interruption switch is provided to give manual control. When the switch is thrown during the tapping cycle, the tapper returns to the top position and stops

until the start switch is actuated.

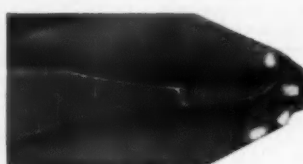
Operating on shop air pressure and 115-v ac, the tapper handles a range of taps from No. 0 to $\frac{1}{16}$. Adjustable torque control is provided for protecting all taps in the range. When desired, the unit can be converted to lead screw tapping by replacing the main spindle drive assembly with a standard lead screw assembly available from the company. *Commander Mfg. Co.*

Circle 54 on postcard for more data

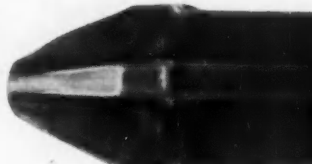


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FREE LITERATURE

Lithium 1

The basic properties and forms, as well as the present and possible uses of lithium, are presented in a 16-page booklet made available by the *American Lithium Institute, Inc.*

Nickel Silvers 2

The properties, forming, machining and finishing of the group of copper, nickel, zinc alloys called nickel silver are discussed in a 16-page presentation available from *The International Nickel Co., Inc.*

Vinyl Cladding 3

Vinyl sheeting for lamination to sheet metal or continuous coils, which gives a durable textured plastic finish to metal products, is the subject of a four-page folder. *Masland Dura-leather Co.*

Blast Cleaners 4

High-speed cleaning applications of a series of blast cleaners, together with specifications on barrels from 1½ to 27 cu ft size, are given in 20-page reference bulletin 703. *Pangborn Corp.*

Headers 5

Both the latest 3/16 in. and 5/16 in. Hi-Pro solid die, double-stroke crank headers for cold heading screw and rivet blanks are presented in four-page brochure 783-A-4. *The Waterbury Farrel Foundry & Machine Co.*

Butyl Rubber 6

Latest information on market developments in butyl rubber, a technical bulletin on evaluation of accelerators (sulfur type cures), a study of carbon black in butyl rubber, and a types-and-properties chart are contained in a portfolio now available. *Thiokol Chemical Corp.*

Conversion Chart 7

A wall chart of conversion factors includes conversions such as inches to centimeters, watts to horsepower, and cubic feet to liters, as well as atmospheres to kgs/sq cm, cm/sec to mph, microns to meters, and quintal to pounds. *Precision Equipment Co.*

Machine Tools 8

General catalog M-1961, 71 pages, presents a comprehensive line of milling, broaching, and grinding machines, as well as grinding wheels, cutting fluids, hardening machines, metal forming machines and special machine tools. *The Cincinnati Milling Machine Co.*

Descaling Equipment 9

Hydraulic descaling equipment for the removal of scale from bars, slugs, and rolled mill products prior to hot working, is described in 36-page catalog D57C. Units for crankshaft, axle and other continuous production lines are included. *The Commercial Shearing and Stamping Co.*

(Please turn page)

4/1/57

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Metallizing Powder 10

Engineering Data Sheet 53, two pages, discusses the use of a new metallizing powder for producing crankshaft bearing surfaces. *Wall Colmonoy Corp.*

Portable Tools 11

Listed in a 50-page catalog are industrial portable power tools and accessories, such as saws, sanders, planes, routers, drills, shears, and drivers. *Skil Corp.*

High-Pressure Valves 12

High-pressure valves for industrial hydraulic systems, with ranges from 1500 to 20,000 psi working pressure, are covered in an eight-page, illustrated catalog issued by *R. D. Wood Co.*

Continuous Furnace 13

Bulletin SC-177, four pages, includes specifications, process recommendations, and applications for a line of continuous heat-treating furnaces. *Surface Combustion Corp.*

Grinders 14

A line of grinder tools, including surface grinders, floor and bench model tool grinders, and workholding accessories are covered in an eight-page bulletin issued by *Walker-Turner Div., Rockwell Mfg. Co.*

Sealing Materials 15

Size ranges, general specifications, and performance data for a line of fluid-sealing products are given in a 12-page bulletin published by *Chicago Rawhide Manufacturing Co.*

Electric Furnaces 16

Box-type electric furnaces for tool-room uses, and available in six basic types covering applications from drawing temperatures as low as 300 F to sintering temperatures as high as 3100 F, are covered in 12-page bulletin 28-150. *Westinghouse Electric Corp.*

Aircraft Components 17

A comprehensive 20-page bulletin, GEA-6217A, deals with accessory systems and components for aircraft. *General Electric Co.*

Diamond Tools 18

Diamond dressing tools, including single stone dressers, blade-type tools, shaped diamond tools, and others, are described in a folder made available by *Craine-Schwartz Diamond Tool Co.*

Turret Punch Press 19

Bulletin 500D features a heavy-duty turret punch press equipped with direct measuring gage and table. *Wiedemann Machine Co.*

Optical Instruments 20

Booklet D-1059 outlines different ways of using optical instruments to simplify and speed manufacturing and inspection procedures. *Bausch & Lomb Optical Co.*

Gear Facilities 21

Facilities for gears, transmissions, and other machined parts are fully covered in a 24-page catalog offered by *New Process Gear Corp.*

Special Steels

Designed for steel users, a new 232-page catalog lists over 700 products available from stock. The book index lists 16 categories of special-purpose steels, including high-speed, tool, stainless, alloy and machinery, available in 16,000 grades and sizes. Over 20 estimating, conversion and weight tables are also included. Address request on company letterhead to *Crucible Steel Co. of America, Box 1558, Pittsburgh 30, Pa.*

Thread Standards

The new 1957 revisions of Unified and American screw threads ASA B1.1 are contained in a company publication. It presents the major, minor and pitch diameters giving the classes, allowances and tolerances of internal and external threads up to and including two inches. Address request on company letterhead to *The Eastern Machine Screw Corp., New Haven 6, Conn.*

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NEW

PRODUCTS

AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Truck Headlamp

Four ruggedizing features have been incorporated in the new Vision-Aid 5440-S 12-v truck and bus headlamp. The improvements include: a spot weld which joins two lead wires



together; a ceramic collar which stiffens the entire filament structure; a re-proportioning of both filaments which makes both more resistant to shock and vibration; and a flexible spring member welded to special support shock mounts to isolate the fog cap from filament structure. The lamp is now in full distribution. *Tung-Sol Electric, Inc.*

Circle 60 on postcard for more data

Gasketing Materials

Asbestos fiber gasketing materials, in a line just announced, feature flexibility, ease of application, and increased durability. Sharp bending will not cause the new materials to pipe or crack. Their toughness and flexibility permit easy handling, and allow for clean die-cutting operations without loose fibers to contaminate contained fluids or clog orifices. These characteristics are said to result from the manufacturing process under which the fiber sheet materials are made. In this process, the asbestos fibers are refined to eliminate lumps

and bunches of fibers. The fibers are then coated uniformly with rubber binder by a patented "beater-saturation" process. In this operation, special saturants are added to a water slurry before the composition is formed.

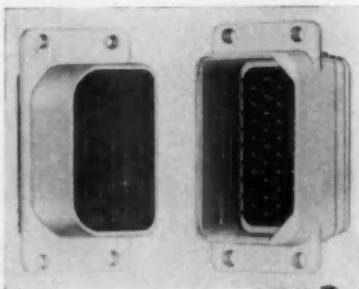
In test installations, the materials are stated to show perfect sealing performance with minimum bolt torque loss, where flange temperatures are up to 500 F and internal liquid pressures up to 500 psi. Data are being developed on these compounds for higher temperatures and internal pressures.

Sold under the trade-name Accopac, the gasket compositions are available with styrene-type, nitrile-type, or chloroprene-type rubber binder, and can be supplied as roll goods, sheets, or die-cut parts. *Industrial Div., Armstrong Cork Co.*

Circle 61 on postcard for more data

Electrical Connector

Known as the Type SR, a rack and panel electrical connector has been developed that incorporates a solid shell and resilient insert to facilitate pressurization and to give maximum protection against harmful effects of vibration. Said to be easily pressurized to latest MIL specification,

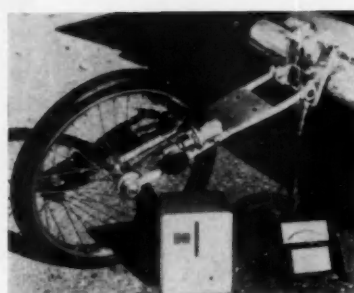


other stated features are low contact engagement forces, closed entry sockets, heavily gold plated contacts, and cadmium plated clear irridite finish. Operating temperature range is -67 to +250 F. *Scintilla Div., Bendix Aviation Corp.*

Circle 62 on postcard for more data

Fifth Wheel

Designed for precise speed and distance measuring, a new and improved fifth wheel called the Model 426 Trackmeter has been announced. Quickly attachable to the rear of a



vehicle, it consists of a 26-in. wheel driving a tachometer generator and is available with an indicating speedometer accurate to one-half per cent and an electronic counter capable of counting off one-foot distance increments. Cables are provided to enable mounting the speedometer and counter inside the vehicle. *Performance Measurements Co.*

Circle 63 on postcard for more data

Scratch-Proof Coating

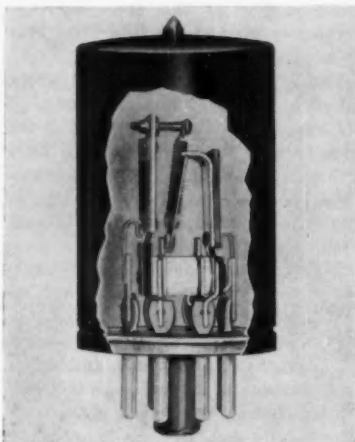
The development of a new process for bonding Du Pont Mylar polyester film to a variety of other materials, including steel and aluminum, has been announced. The film is said to give a scratch-proof and corrosion-resistant surface. It is embossed in patterns with deep grooves and ridges. Expected applications include use as automobile trim.

Sheet metal covered with the Mylar can be drawn, stamped or otherwise shaped after the surfacing has been applied. The company also says that studs can be spot-welded on the rear sides of the metal backing, and that the material can be drilled or sawed without damaging the surface. A thermo-setting adhesive is used in the bonding process. *Seiberling Rubber Co.*

Circle 64 on postcard for more data

Time Delay Relay

The recently-announced Thermal Memory Relay is a bistable time delay relay with single-pole, double-throw snap action contacts. The relay is thermally operated, having two separate heater circuits. Each heater serves to transfer a movable arm from one contact to the other. The relay remains in either of the two contact positions until operated by



means of the appropriate heater circuit. Because of the thermal actuating characteristics, a time delay is associated with each operation.

The bimetal strips are matched to cancel the effect of ambient temperatures upon relative deflection and to insure consistent operation. Operating time of the unit is factory preset for either 20 or 30 sec on both transfers. The relays are temperature-compensated from -55 to $+100$ C, and have standard voltage rating of 6.3, 26.5 or 117-v. Other voltages are available upon request. Heater power is 2.7-w for each heater. The relay has a reported minimum life of 500,000 operations under average operating conditions. *Electronics Div., Curtiss-Wright Corp.*

Circle 65 on postcard for more data

Filament Wire

Development of a tungsten filament wire of added strength, for automobile and other lamps, has been revealed. Known as M-wire (muscle wire), the material is said to offer unusual resistance to shock and vibration. Standard laboratory shock tests on different types of automotive lamps showed the new wire to be four to nine times stronger than ordinary filament wire. Preliminary field tests

on trucks have also shown markedly superior results, it is said. The use of the wire and an improved filament design in 12-v lamps indicate a materially increased bulb life.

Several types of 12-v automotive lamps are already being manufactured with the M-wire, the company reports. Others will be made available as soon as manufacturing facilities permit. It is expected by the company that eventually the wire will also find applications in non-automotive lamps and for military use. *Lamp Div., Westinghouse Electric Corp.*

Circle 66 on postcard for more data

Gold Tape

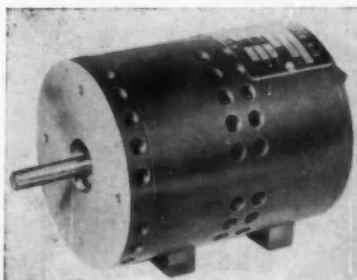
Offered as a low-cost means for providing decorative metallic trim, a new "gold" tape is resistant to corrosion and abrasion. Identified as Scotch brand gold polyester film tape No. 850, it has a high metallic lustre and can be cleaned like any polished metal. Tensile strength is 21 lb per inch of width, and the tape has an adhesion of 35 oz per inch of width. *Minnesota Mining and Manufacturing Co.*

Circle 67 on postcard for more data

Aircraft Motor

Developed for airborne fan, pump and actuator applications, a new 5500 rpm, eight-pole aircraft motor delivers $\frac{1}{2}$ -hp continuously to 50,000 ft altitude. Of the induction type, it operates on three-phase, 400-cycle, 200-v ac. Weight is $4\frac{1}{2}$ lb.

The Type A motor is flange-mounted to the driven equipment, and is provided with either an extended shaft for heat exchanger fan duty



or a standard shaft for pumps and actuators. Pads are furnished on the side of the motor for mounting accessories. *Aircraft Div., U. S. Electrical Motors Inc.*

Circle 68 on postcard for more data

Stainless Fasteners

Type "H" Pushnut fasteners for unthreaded studs of die-cast nameplates, medallions, grilles and ornaments are now available made of 410 stainless bright hardened steel, for applications requiring a high degree of corrosion-resistance. Design features are: four gripping teeth for holding tight even on hard or slippery plated studs; long spring arch to compensate for wear on parts; turned up

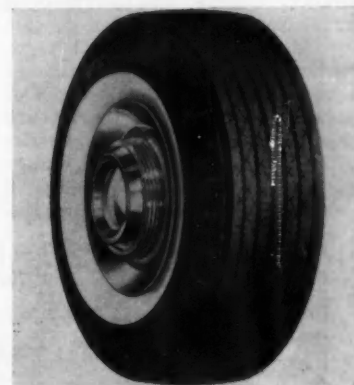


ends that slide smoothly and prevent damage to seating surfaces; and easy, fast assembly with hand or power tool applicators. Sizes are available for $1/16$, $3/32$, and $1/8$ -in. studs. *The Palmnut Co.*

Circle 69 on postcard for more data

Passenger Car Tire

Called the Ultra DeLuxe Nylon Tubeless, a new 14-in. series of tires has been introduced that is said to offer protection against blowouts, punctures and flats, increased traction, high mileage, soft riding, and quiet operation. Nylon pre-stretched



cord is used in the carcass. The inside is lined with a double layer of soft rubber for sealing off puncturing objects. Tread is compounded of cold rubber. The traction slits and saw-toothed edges of the tread are arranged in a variable pitch pattern for noise cancellation. Obtainable with either white or black sidewall, the tire is available in the four 14-in. standard sizes. *Lee Rubber & Tire Corp.*

Circle 70 on postcard for more data

Car Suspension Era at Hand

(Continued from page 51)

provides a torque ratio between the axle shafts which is based on the amount of friction in the differential and the amount of load that is being applied to the differential. When turning a corner this process is in effect, partially reversed. The differential gears become a planetary gear set with the gear on the inside of the curve becoming a fixed gear of the planetary. The outer gear of the planetary over-runs as the outside wheel on the curve has a further distance to travel. With the outer-gear over-running and the inner-gear fixed, the pinion mates A are caused to rotate, inasmuch as they are restricted by the fixed gear they first must move the pinion mate shafts B, back down the cam surface C, relieving the thrust loads on the clutches E when turning the corner.

The Thornton Powr-Lok differential for all practical purposes is similar to a conventional differential and the wheels are free to rotate at different speeds. The engagement of the clutches in the Thornton differential provide

many features in this unit that are not common in other types of locking differentials. On straight driving, the clutches are engaged thus, prevent momentary spinning of the wheels when leaving the road, or when encountering poor traction. Turning the corner, the load is relieved from the clutch surfaces, so that wear is reduced to a minimum. Field experience with the Thornton Powr-Lok differential has indicated that shock loads are less severe than with the conventional differential. This is because wheel spinning is reduced to a minimum. Shock loading on the axle and the drive train is also reduced due to the fact that the wheel does not spin and suddenly obtain traction imposing a shock load on the axle and drive line. Experience with the Thornton Powr-Lok unit in production has also indicated that this type of unit is probably here to stay. Some of the automotive manufacturers who are now using this unit have increased their requirements to as much as 50 per cent of their vehicle sales.

The New Ford Axle

BY BAIN GRIFFITH
Ford Motor Co.

EARLY in 1955 Engineering Staff recommended for use on the 1957 Ford and Mercury cars and ½-ton Truck a new design of rear axle incorporating a straddle-mounted pinion for improved rigidity of structure and potentially greater torque capacity and life. Further chassis design studies indicated the possibility of continuing with a single propeller

shaft on the 1957 passenger cars if the axle design could be revised to an increased pinion offset. After a brief but intensive period of gear development work and testing, practicability of the 2¼ in. offset axle was indicated and accordingly the 1957 car development program was committed to the design. Pinion offset in 1956 was 1½ in.

The differential case is of two-piece design, more or less spherical, with small holes for lubricant, to obtain maximum stiffness with a minimum of metal. It is in malleable iron. Pinion bearings are relatively small, high in angle, and are the same in all applications. Two sizes of differential bearings are used; the smaller is in the Ford passenger cars, and all other applications use a somewhat larger pair of bearings. It is interesting to note that the five bearings in the 1957 axle cost about the same money as the four bearings previously used in the 1956 Ford rear axle.

The most interesting feature of the entire problem has been the design of the hypoid gears. Development of the wide range of gear ratios from 2.9:1 to 5.8:1 (see Table I), for acceptable noise characteristics has been, as might be expected, somewhat difficult. Previously used assumptions in gear calculations and manufacturing techniques required modifications and re-development.

Our original formula relating dynamometer life experience and structural fatigue of hypoid gear teeth indicated that severely offset gears were structurally superior to conventionally offset gears of the same size. The validity of the formula with the extreme change in tooth proportion was questioned, but endurance tests were performed with gratifying results. Testing at the present time indicates definite fatigue strength advantages. The tabulation in Series I of Table I shows the input torque and tooth loading data that has resulted in an average of a million pinion cycles with successful fatigue life.

There are currently in production 16 different ratios with no change in gear mounting distance. All ratios are interchangeable in the same differential carrier with the same differential case. Spiral angles on the gears, however, vary from 45 deg on the fastest ratios to 60 deg on the slowest. Table I indicates the design quantities of the entire range.

It is interesting to add that the design strength and the flexibility with respect to fatigue life, ratios adapted, and possible future requirements for added gear capacity have been obtained with modest assembly weight. Our 1956 assembly weighed 57 lb and the 1957 assembly weighs 65 lb; all but one-half pound is directly attributed to the increased offset in forging and casting requirements; the range of gear ratios is also much broader. Minimum competition weighs 64.25 and the balance of 1957 production in the field ranges heavier to 80 lb.

TABLE I
Design Values —1957 Ford Motor Company Axle Gears
8.75 P.D. GEAR, 1.375 FACE, 2.25 OFFSET DOWN

	Ratio	No. Pinion Teeth	No. Gear Teeth	Pinion Spiral Angle	Gear Spiral Angle	Pound Feet Torque Input	Pinion RPM
SERIES I REGULAR PRODUCTION	2.91	11	32	47° 30'	15° 21'	970	500
	3.10	10	31	50°	17° 19'	970	500
	3.22	9	29	50°	17° 2'	970	500
	3.56	9	32	50°	18° 21'	875	500
	3.70	10	37	50°	18° 7'	840	500
	3.89	9	35	50°	15° 47'	840	500
	4.11	9	37	50°	15° 30'	730	500
SERIES II SPECIAL	3.40	10	34	50°	18° 38'		
	4.29	7	30	55°	20° 14'		
	4.57	7	32	55°	19° 57'		
	4.72	7	33	55°	19° 48'		
	4.88	7	34	55°	19° 38'		
	5.14	7	36	60°	24° 7'		
	5.43	7	38	60°	23° 57'		
	5.67	6	34	60°	23° 50'		
	5.83	6	35	60°	22° 46'		

Series I includes dynamometer loading; average life exceeds 1,000,000 pinion cycles.

For
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PACKARD CLIPPER ENGINES



STUDEBAKER-PACKARD CORPORATION...one of the leading engine manufacturers selects and distributes Perfect Circle chrome rings for authorized replacement service

PERFECT CIRCLE

2-in-1 CHROME PISTON RINGS...*the standard of comparison*

Observations

By Joseph Geschelin

Axle Lubes

The session on rear axles at the recent SAE National Meeting in Detroit focussed attention on lubricants. Recent studies indicate that properly designed gear sets with Lubrized gear surfaces can give acceptable performance when using inactive lubes rather than the active types now considered imperative.

Unique Drives

In watching the proceedings of the SAE National Meeting in Detroit in March we came away with the impression that many designers are willing to take a better look at rear engine drives. A lot of things have happened since the days before the war that make this arrangement more practical. Too, designers will want to take another look at front drive. Here too a lot of things have happened since the days of the Cord and the several other makes of front driven cars of that era.

Vacuum Melted

The recent SAE session on vacuum-melted metals was intensely interesting. There is no doubt whatever that metals produced by vacuum melting offer many important advantages. Of course, there is always the matter of economics. These materials may not be justified at the moment for common automobile applications. But for

aircraft engines, jet engines, and for applications where special alloys and unique properties are required the vacuum-melted metals and alloys can be justified on any grounds. Listening to the experts we were impressed with the fact that still more research work is required to uncover not only the advantages but also the role of the process. For example, several metallurgists wanted experimental evidence on the effect of freedom from gas on the properties of metals. Is it as important as freedom from inclusions and are there cases where freedom from gases may be even more important?

Silicon Cells

Latest word is that a number of companies are working on the development of silicon cells for use in compact rectifiers. This move is in preparation for the probable acceptance of some form of alternator system tailored for passenger cars in the next few years.

Feed Back

As new machine tools are disclosed, those intended for use on automation lines feature feedback mechanism in many instances we have observed. Function of this memory circuit is to readjust the relationship of the work and tools to compensate for tool wear. Usually the feedback mechanism will readjust for size control when three to five pieces are found to be off toler-

ance. This has great importance on fully automatic lines in which individual machines are equipped with automatic gaging devices. It is instrumental in reducing if not eliminating rejects.

Noise Test

Out of the session on rear axles at the recent SAE Passenger Car Meeting in Detroit came the suggestion that the industry needs badly some advanced form of equipment and instrumentation for noise studies. In the opinion of the speaker the present facilities in laboratories and in production are inadequate for the purpose. What is needed is entirely new methods and better instrumentation. Here is a worthwhile goal for specialists in electronics.

Factory Aiming

Val Roper's SAE paper on the new dual headlamp system brought out some interesting discussion. For one thing it appears certain that every make of car in 1958 will have dual headlamps. What is equally important was a comment to the effect that by that time the factories will have available simple mechanical aiming fixtures right on the assembly line. These fixtures are inexpensive, take practically no space in length, and are easy to operate. The net effect of these developments will be to provide cars off the line that have accurately aimed headlamps.

Latest in Nuclear Equipment And Materials Viewed at Show

Unveiled at the 1957 International Atomic Exposition in Philadelphia last month was the largest and most complete display of components for non-military uses of nuclear energy yet seen in this country. Exhibits of nuclear equipment and materials represented nearly every segment of business, industry, and government in the field of nuclear energy.

One of the highlights of the show

was a working nuclear reactor built by Aerojet-General for production of radioactive isotopes. The actual energy producing unit is now in volume production.

Hundreds of other technical items such as reactor fuels; mechanical arms for handling radioactive materials; latest radiation and detection devices; special electronic and control instrumentation; miniature nuclear batteries; latest applications of rare earth metals and rare gases; and illuminated telescopic instruments for

internal inspection of inaccessible parts were also on display.

Presented at the concurrent Nuclear Engineering and Science Congress were 130 technical papers dealing with various phases of nuclear operations from mining to the disposal of radioactive waste. Emphasis was on new developments of potential value to civilian industry, especially in the fields of metallurgy, chemical processing, mechanical and power application.

USING DU PONT ELASTOMERS

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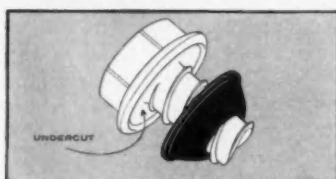
in design



HYPALON protects whitewalls from ozone cracking and discoloration

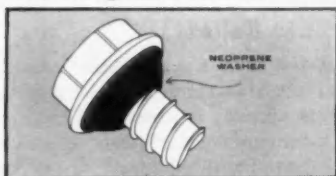
NEOPRENE washers are
integral part of leakproof,
cushioned fastener

A combination of an undercut head design and a conically shaped neoprene washer gives special advantages to these fasteners.



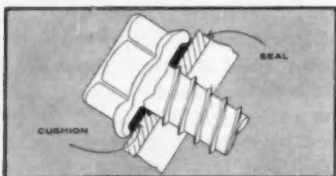
Undercut of fastener head . . .

The washer cushions the head and prevents metal-to-metal contact. Finishes are protected; transmission of vibration noise and squeaks is reduced.



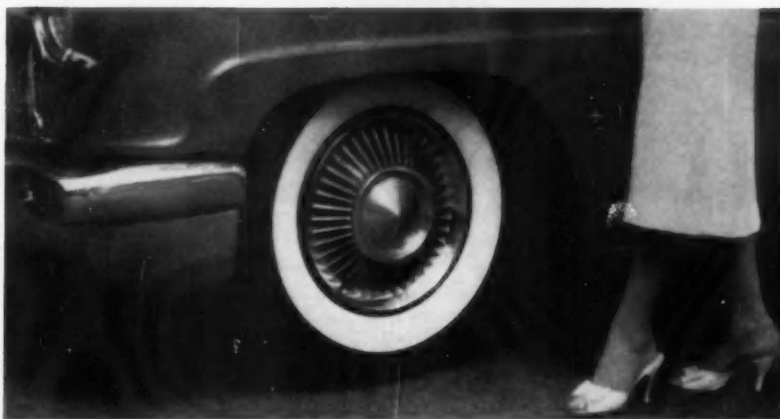
. . . confines and controls flow of
conical neoprene washer

As the fastener is secured, the undercut head confines and controls the spread of the resilient neoprene washer, which, in turn, flows into the top threads and seals the fastener hole.



. . . so washer seals the hole and
cushions the fastener head.

It's another example of good design made possible with a part made of neoprene—the Du Pont synthetic rubber that is used throughout the automotive industry for resistance to oil, ozone and weather. Just clip the coupon for more information.



Lasting whiteness for sidewalls is
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ozone concentrations above average

Small amounts of ozone in the air are a primary cause of whitewall deterioration—but a leading tire manufacturer has met this problem by using a special rubber compound containing a substantial amount of HYPALON—Du Pont's new synthetic rubber. Road tests in Los Angeles, where ozone concentrations run higher than average, showed that the whitewalls stayed white and free from cracks through long service periods. These tests have also shown the HYPALON compound to have outstanding resistance to abrasion.

New Design Opportunities

HYPALON's color stability, its outstanding resistance to ozone, elevated temperatures and weather are now being utilized in the automotive field. For example, HYPALON spark plug boots combine immunity to ozone with excellent heat resistance. HYPALON-coated door and window stripping is superior in sunlight and weather resistance. HYPALON-covered ignition wiring shows unusual resistance to hardening at elevated temperatures (250°-350° F.). HYPALON-coated fabric makes colorful, durable convertible topping.

Many possibilities for HYPALON remain for practical application to automotive design. For more information, just clip and mail the coupon below.



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METALS

Incoming Orders for Steel Fall Below Present Shipments. Lead and Zinc Still Depend Upon Continued Buying for the Stockpile.

By William F. Boericke

Steel Operating Rate Declines

There is now little lingering doubt that the steel industry had set its sights too high at the start of 1957, and with the first quarter ended, a calmer appraisal is taking place of production and demand. It is now admitted generally that shipments are outdistancing incoming orders and backlogs are declining. Flat-rolled products, particularly cold-rolled sheets and strip are in easy supply—perhaps one should say in over-supply. Within a scant three or four months, the change has been from a sellers' to a buyers' market. Incoming orders account for no more than 90 per cent of shipments. The operating rate has declined from close to 100 per cent in December to less than 93 per cent by mid-March and some cautious estimates forecast a drop to 85 per cent in the second quarter.

Reasons for the declining rate are not far to seek. The automobile industry has not been calling for the anticipated amount of steel. House building starts are off drastically. Some ambitious new industrial programs have been curtailed or deferred. Appliance manufacturers have cut inventories and lowered work schedules. Business is still good and the steel industry could still have a very good year, but most producers would gladly settle for 1956 sales volume.

Still in heavy demand are structurals and heavy plate, but the call for oil country goods is definitely less. With plentiful supplies of such items as flat rolled products, galvanized sheets and wire products, many mills are turning their facilities where possible to production of light plate. Some of the big integrated producers with a wide product-mix are pairing off orders for tight steel items with those in more plentiful supply.

Can Steel Base Prices Be Advanced in July?

Under these conditions it is becoming more doubtful if the industry will be able to pass on to consumers the anticipated base price increases that were scheduled to follow the automatic wage increases of next July. The announced opposition by the Administration to further price increases is bound to have a sobering effect. In the meantime, however, some prices have already been raised, reflecting higher wage and material costs. Extras have been boosted three

or four per cent, amounting to about \$5 per ton. U. S. Steel raised the price of tin plate 4½ per cent, to take effect April 30 and to hold through November. This created bitter protest from the container manufacturers.

As was fully anticipated, Cleveland Cliffs raised the price of iron ore by 60 cents a ton, thus setting the pattern for the year. This was closely followed by a \$2 increase in the price of pig iron to \$65 per ton. Significant was the announcement there would be a delayed start in shipments of iron ore down the Great Lakes because of sluggish steel demand and large ore stocks at the Lake ports.

The scrap market is living up to its historic role as a forecaster of steel demand. The price has sagged steadily since February 1 and by mid-March heavy melting scrap was offered at \$54 per ton, with demand slow. Inventories of scrap appear ample.

Conversion deals are out. The quota system, put in effect when steel buyers were hammering at the door, has been quietly forgotten. Export demand is still good for certain products, notably structurals, but these are the very ones that can be readily sold in the domestic market.

More Nickel Coming, But Little Immediate Relief

Occupying a unique, and from the producers' standpoint an envied supply position among all the metals, nickel is still critically scarce, as is keenly realized by every consumer. It is dubious comfort to realize that supply should be more comfortable in four years hence when International Nickel's vast new Mystery Lake project comes into production. It is estimated that the company's nickel output by 1961 will total 385 million lb or 100 million lb more than 1956.

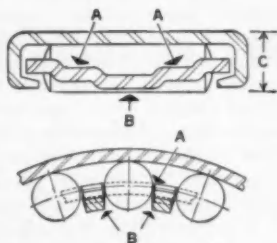
Producers of stainless steel, vitally dependent on nickel supplies, are handicapped because of allocation of the metal by the major producer. Some have been obliged to get most of their metal as scrap which has been selling in the open market at nearly three times the official price of electrolytic cathodes.

To some extent the outlook is brightened by the Government's diversion to industry of 47 million lb that was originally destined for the stockpile. Announcement has also been made that Freeport Sulphur plans to build huge new nickel producing facilities in Cuba that will eventually produce about 50 million lb annually. But this production still is two or three years off. The same comment applies to production from the new extensively publicized nickel-copper

(Turn to page 104, please)



Features of the new
**TORRINGTON DRAWN CUP
ROLLER BEARING**



- rollers end-guided at pitch line (A)
- shaft-riding retainer (B) designed to permit lubricant circulation
- high capacity in small cross section (C)
- long pregreased life
- efficient at high speeds
- mounted by press fit
- simple housing design
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This compact, lightweight bearing consists of spherical end needle rollers, a one-piece hardened steel retainer and case-hardened thin-section outer race. Designed to run on a hardened shaft or with an inner race, this new series takes a press fit in a simple housing without snap-rings or shoulders.

Highly efficient roller guidance and lubrication are outstanding features. The shaft-riding retainer contacts the roller ends at the pitch line where guidance can be obtained with the least effort. The design provides ample storage for lubricant and promotes its circulation.

These features make the new bearing particularly suited to applications requiring compactness with precision, high-speed endurance or long pregreased life.

For information on sizes now available and for application assistance, call on our Engineering Department or write for the new bulletin, "Torrington Drawn Cup Roller Bearings." THE TORRINGTON COMPANY, Torrington, Conn. — and South Bend, Ind.

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AUTOMOTIVE INDUSTRIES, April 1, 1957



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Unitcast



**QUALITY
STEEL
CASTINGS**

Conveyor Systems

(Continued from page 57)

In general, the same principles underlie the arrangement of other kinds of production lines regardless of the character of the operation.

An interesting example of a compact process line for a specific part is one for producing the tie-rod socket.

Raw material is drawn to uniform size in the wire drawer and straightener, then is cut off and formed in the $\frac{3}{4}$ in. National cold header. The blanks then are transported into one of four large storage hoppers. The hoppers are opened manually to permit the flow of parts to either or both of two supply hoppers located near the Tocco unit.

Press operators load blanks manually in the heating fixtures, remove them as the fixtures reach the loading station, then perform the forging operation. Following this, the forging drops down a chute to a conveyor under the heating fixture and is transported upward into two of four large storage hoppers, for cooling prior to shot blasting. Before shot blasting, the parts are counted by weighing a skip hoist load, thus affording an estimate of the proper load for the machine as well as an accurate count. After shot blasting, the parts are discharged to a conveyor for transport to any one of four supply hoppers serving the coining presses.

Undoubtedly one of the biggest advances in production economy has been accomplished in the layout and mechanization of the central heat treating department. Among the prime objectives in developing this department were: a reduction in direct labor through better arrangement of equipment and mechanization; reduction in time usually lost in trucking materials; a compact arrangement designed to conserve floor space; and a major reduction in production control due to the flexibility of the equipment.

In essence, the heat treating department has been divided into three major zones as follows:

1. System 1 and 1A—Employing Ipsen and Surface Combustion furnaces, this zone handles the variety of parts requiring carburizing in System 1; and embodies another circuit for extra high volume jobs requiring special baskets with cups.

2. System 2 and 2A—This zone is set apart for those parts that require salt bath hardening and/or induction hardening. System 2A is a separate circuit for parts that require induction hardening.

(Turn to page 102, please)



HOW R/M SETS THE PACE IN FRICTION MATERIAL DEVELOPMENT

R/M alone manufactures all types of friction materials

Particularly with today's more complex requirements, no single type of friction material can be best for all friction applications. That's why Raybestos-Manhattan, for over 50 years the world's leading maker of friction materials, is in a unique position to help you.

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cellulose parts may give top performance. And where greater heat resistance is required, Raybestos-Manhattan semi-metallic friction materials are widely used.

Unlike other manufacturers, R/M works with *all* kinds of friction materials. Thus, whatever your friction requirements may be—whatever the application—you can be sure of a completely unbiased recommendation when you consult an R/M engineer.

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Write now for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials.



THE TRADEMARK THAT SPELS PROGRESS
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Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics • Rubber Covered Equipment
Abrasive and Diamond Wheels • Laundry Pads and Covers • Bowling Balls

Conveyor Systems

(Continued from page 100)

3. System 3 and 3A—This zone is equipped with Holcroft atmosphere furnaces, primarily for handling small parts. System 3A is arranged in similar fashion, except that it has a different method of handling parts of larger size and more awkward shapes.

System 1 and 1A embraces three Ipsen T-800 atmosphere furnaces and two All-Case Surface Combustion fur-

naces. It is served by a Triplex belt washer and a Schmiegl belt washer. Work handling is facilitated by means of Work-O-Matic stands and a system of gravity roller conveyors with built-in basket dumps, turntables, and gravity chutes.

In operation, fork trucks deliver Work-O-Matic bins of material into inline Work-O-Matic stands mounted on a rack. The heat treat operator meters the material into baskets on roller conveyors, then pushes the baskets on the conveyor leading into a washer. Following this, the basket is pushed on the conveyor to one of

the furnaces. At the end of the furnace cycle the operator pushes the basket into another washer, then to a dump station into a Work-O-Matic bin where the load awaits removal.

As mentioned earlier, the extra high volume parts are processed over System 1A. Here the fork truck delivers the bin to the high stand from which the heat treat operator loads into special cups in baskets on the roller conveyor. These baskets then are loaded into an Ipsen furnace. Following this the operator pushes the baskets onto a spur roller conveyor, to a dump station and onto a cleated belt conveyor through the wash and into a storage bin.

In System 2, parts are delivered in bins and placed on a high stand from which the operator meters them into a basket on the roller conveyor, then pushes the basket into the All-Case Surface Combustion furnace. After this the operator pushes the baskets to a dump station into a floor hopper from which they are conveyed through the washer, then up an elevator onto an overhead conveyor and into a hopper. The operator loads work into baskets and the latter, in turn, are lifted by an overhead hoist for placement in the Holden neutral salt draw furnace. The basket then is lifted out of the salt bath, quenched and dumped into a rust preventive tank. The conveyor carries the parts out of the tank to an overhead conveyor, through a washer and into a Work-O-Matic bin.

System 2A is used for parts that require induction hardening as well. In such cases the parts go through the same procedure as is outlined immediately above, except that upon leaving the rust preventive tank they are side-tracked by a gate and are dumped into a hopper instead of the storage bin. At this point the operator loads the parts into the Magnathermic unit where they are kicked out automatically onto a conveyor for transport through a washer. Following this the parts are gated back into the system into a hopper at the Ipsen draw furnace. Here the operator loads the basket of parts on the roller conveyor and pushes it into the furnace. Upon completion of the cycle, the basket is pushed onto a dump station, into a storage bin and is ready for removal by fork truck.

System 3 is intended for parts requiring heat treatment in Holcroft furnaces. Spanning the line of furnaces is a track, carrying a dolly, and having a separate spur roller conveyor with a dump station at each end. The operator meters parts into

(Turn to page 104, please)

use a **HYDROSCALE ON YOUR CRANE HOOK!**

weigh the
modern way!
cut your costs!



ALL WEIGHING IS DONE ON YOUR CRANE HOOK

You merely hang the HYDROSCALE on the crane hook, or hoist, and leave it there. Then, whenever you lift a load, you'll automatically weigh it, as you lift it. No extra equipment or plant facilities are required.

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By eliminating the central weighing station, you realize substantial savings in time, floor space and money. And, you provide for automatic weighing at any step in your crane operations, at a fraction of the former cost.

TYPICAL WEIGHING APPLICATIONS

Just a few of the many applications include—loading, unloading, batching, check weighing, foundry charging, production control, process control, checking inventory, and, protecting your equipment from overloading.

COMPLETE LINE OF 110 MODELS NOW AVAILABLE

There's a model to meet most any industrial weighing requirement, and to suit every crane application. Our largest model has a capacity of 200,000 pounds, while our smallest model has a capacity of 500 pounds. They're engineered and built for long service-life, and can be used on any standard crane or hoist.

HYDROSCALES guaranteed

They are guaranteed to be free of defects in workmanship and materials, and to be accurate to 1/2 of 1% of the maximum dial capacity—

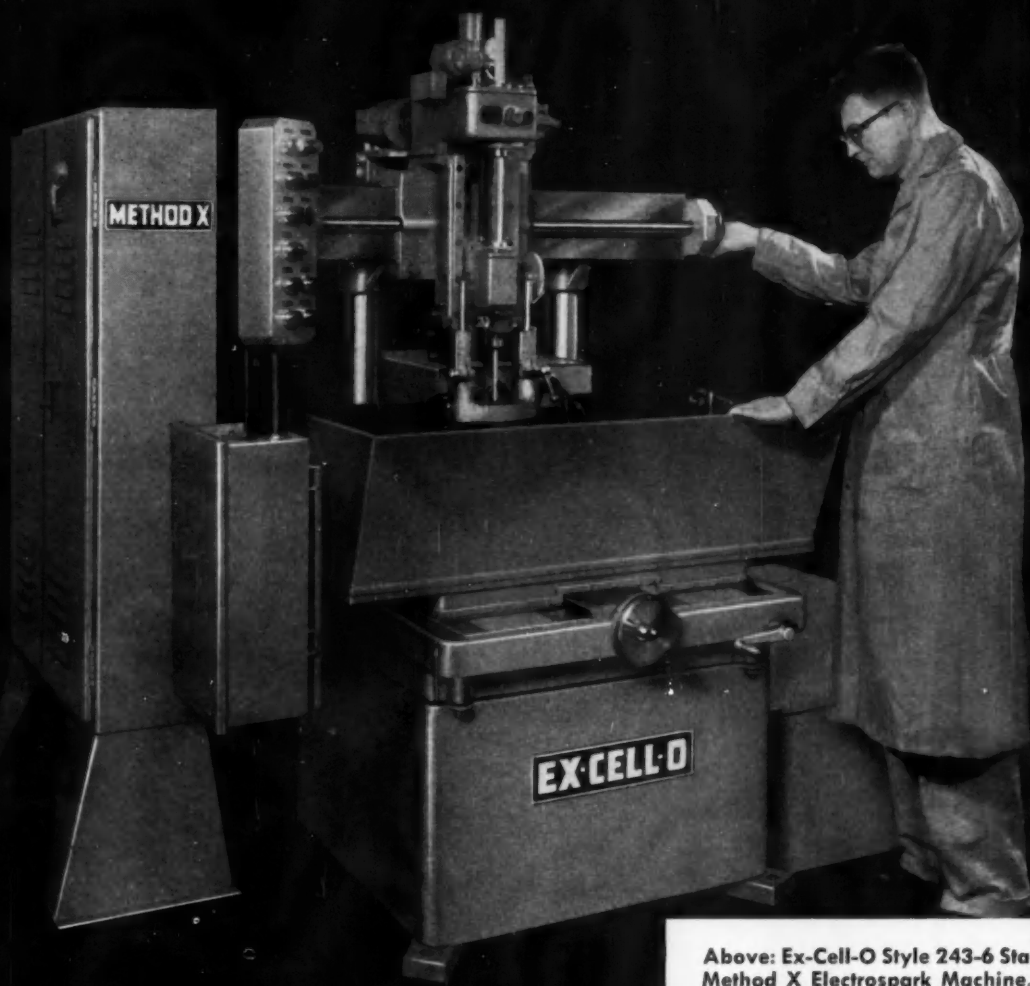
Write for descriptive literature explaining model features.

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"The world's largest producer of crane scales"



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Above: Ex-Cell-O Style 243-6 Standard Vertical Method X Electrospark Machine, and at right, some of the shapes it can cut.

***NEW!* Electrospark Machine**

FOR TOUGH METALS

Sintered carbides and super alloys—in growing demand these days—are costly to machine, and even more costly to scrap. But you can now machine metals of extreme hardness and toughness easily and economically.

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BUFFALO BOLT COMPANY

Division of Buffalo-Eclipse Corporation
NORTH TONAWANDA, N. Y.



Conveyor Systems

(Continued from page 102)

a basket resting on a locked dump, then pushes the dolly down the track to receive the basket. The dolly is pushed down the track to feed into the furnace. In similar fashion, the dolly is returned to a furnace to remove the basket of heat-treated parts. The basket of parts then is dumped into a storage bin for removal by fork truck.

Larger parts are handled in System 3A using the dump on the other side of the furnace line. Here the basket is loaded while resting on the floor, then is lifted onto the dolly by a jib crane. Heat-treated parts then are returned to the dump station and loaded into a storage bin.

Ball joint sockets for 1957 production are made up of a stamped assembly in the main. Stampings for the socket are produced at a high rate by processing through a new 400-ton capacity, six-station Bliss transfer type press. At the end of the process the socket assembly is made up into an integral unit simply by projection welding of the two halves in a special National Electric Welders unit. As illustrated, this machine has an indexing table to facilitate the loading and unloading of parts on the continuously rotating table.

METALS

(Continued from page 98)

deposits in Ungava, Quebec. While the potential here appears large, production difficulties are formidable.

Copper Figures Disturb Producers

The February figures released by the Copper Institute were a shock to the trade which had been expecting better news because of the encouraging trend in January. It now appears that the improvement in January was illusory and did not show the actual situation. In consequence February reflected adjustments that certainly in part should have shown up in the earlier month.

But in any event the February statistics gave no cause for cheer to the much-worried copper producers. On a daily basis domestic crude production was up to 3294 tons, the highest on record, while deliveries of refined

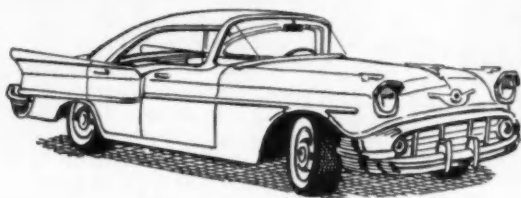
(Turn to page 106, please)

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STERLING'S great "Conformatic" piston with "Intra-Cast" steel ring groove liners give sensationally longer life to rings and grooves—

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Sterling's revolutionary *Conformatic* piston already has been accepted and is now being used in a number of America's finest and most popular passenger cars.

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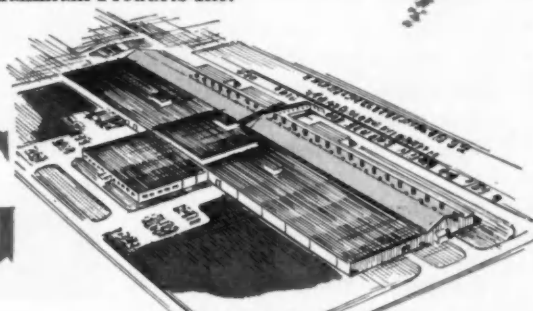
WORLD'S LARGEST MANUFACTURER OF ALUMINUM ALLOY PISTONS

AUTOMOTIVE INDUSTRIES, April 1, 1957



STERLING'S CONFORMATIC PISTON WITH INTRA-CAST STEEL LINED GROOVES

prevents frictional horsepower loss, reduces oil consumption to an absolute minimum, and prolongs engine life up to 400%. *Intra-Cast* and *Conformatic* are registered trade names of **STERLING Aluminum Products Inc.**



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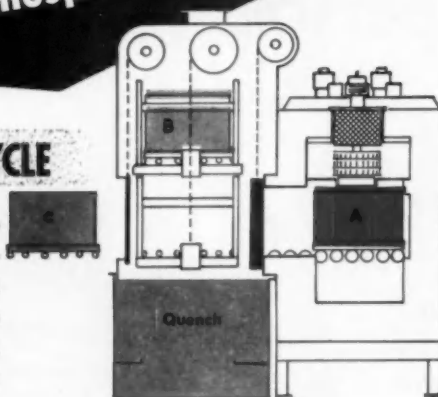
120 acres! Completely new automated plant at the confluence of the Missouri and Mississippi Rivers

SA-1

Sealed Cycle..... A Dow Furnace FIRST for Batch-type controlled atmosphere furnaces.

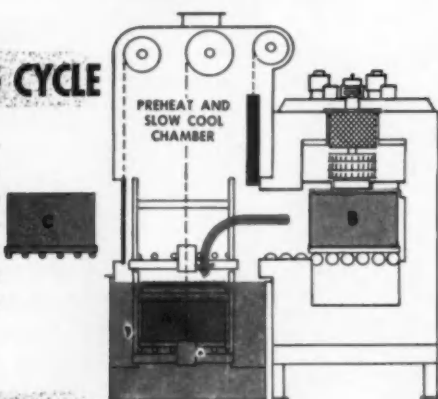
Step 1—LOADING CYCLE

Box A containing full furnace load of parts processing in work chamber. Box B—fully loaded, pre-heats in the upper vestibule. Box C—fully-loaded, waits on conveyor.



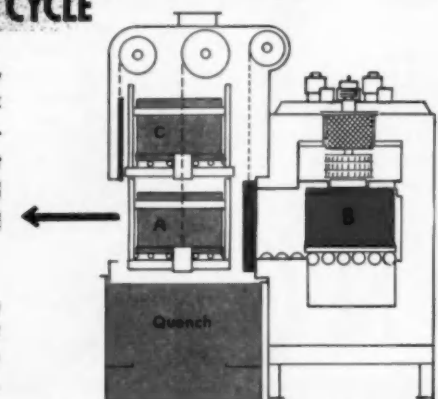
Step 2—QUENCHING CYCLE

Box A completely processed, moves out to elevator and is lowered into quench; bringing pre-heated Box B to loading level. Box B is pushed into heat chamber and door is closed.



Step 3—RELOADING CYCLE

After proper interval, outer door is opened. Box C is placed on upper elevator and raised to pre-heat position as Box A is lifted from quench and removed from lower elevator.



Sealed Cycles' double door seal affords complete flexibility of processing without exposing heat chamber to air contamination.

Upper vestibule is easily adapted for slow cooling. Quench is adaptable for interrupted quenching.

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First WITH
MECHANIZED, BATCH-
TYPE, CONTROLLED
ATMOSPHERE FURNACES

METALS

(Continued from page 104)

metal to fabricators were down to 3627 tons, compared with a daily average in 1956 of over 4000 tons. Stocks of copper were up to 136,330 tons, an increase of 63,000 tons in the last six months.

Overseas the story was no better. Foreign crude output was up sharply while deliveries were off from January, although substantially more than the daily average last year. Considered on a world basis, refined production for February totaled 242,780 tons, while deliveries were 214,800 tons. That's an indicated surplus of almost 28,000 tons for the month; it brought world stocks up to 370,000 tons, highest since 1953.

All this adds up to an unescapable conclusion, that if the 32 cent price level is to be maintained—in mid-March it was a shade under 30 cents a pound in London—either demand must improve or production must be cut back.

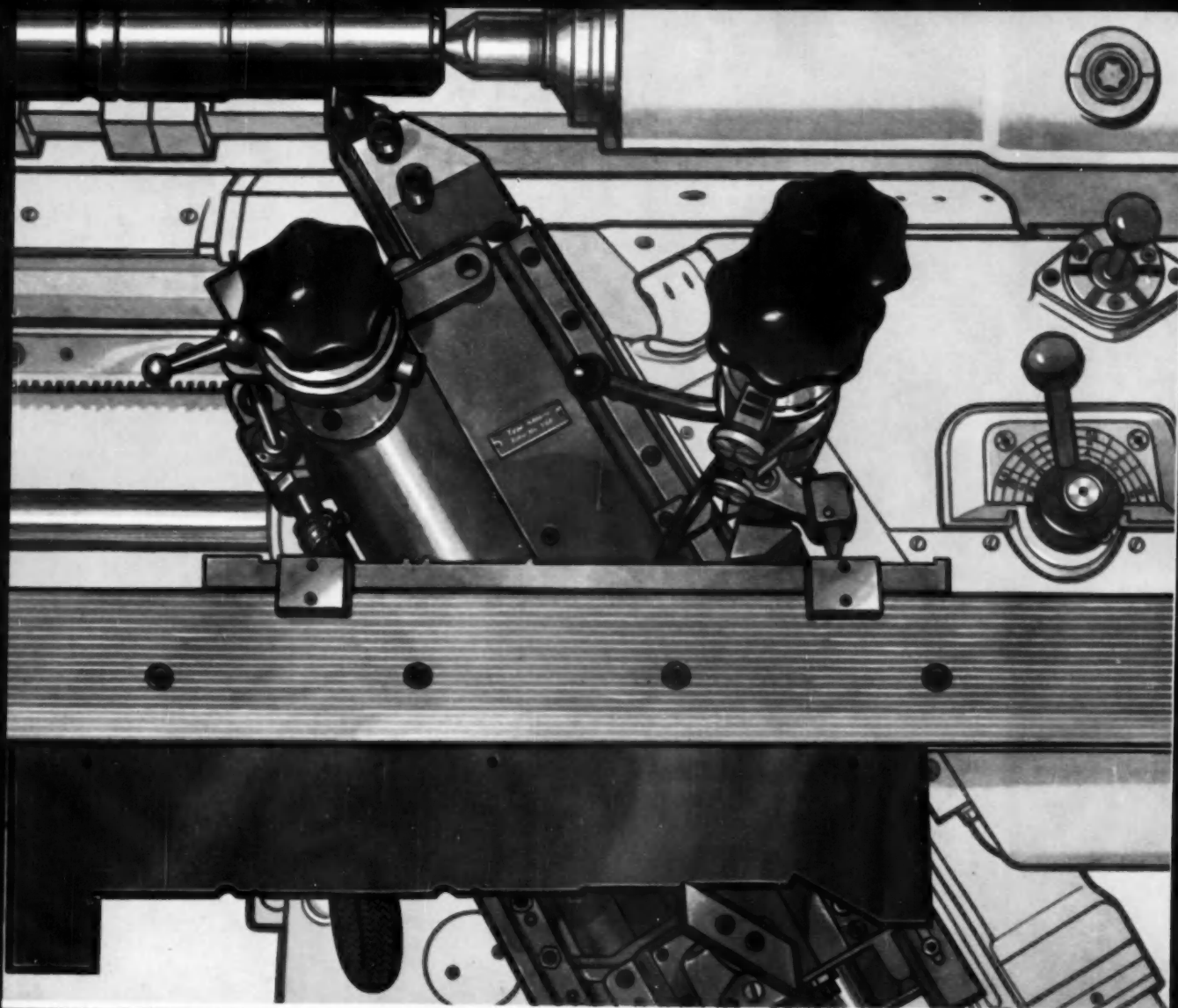
Brass Business Slow, Wire Mills Good

The outlook for better domestic demand is only fairly good. Abroad the prospects look better, with Suez again functioning normally. Domestic brass fabricators can see no sign of any immediate gains but wire and cable manufacturers are less concerned because of excellent demand from the utilities. Brass mills report their customers have cut their inventories to the limit, as evidenced by small orders and insistence on immediate delivery. Any increase in business for the second quarter depends largely on improved calls from Detroit. Prospects from residential construction—normally a big market for brass products—are considered dim because of the expected 20 per cent drop in housing starts from the 1956 level.

Production Cutbacks May Come

With mounting crude output more consideration is being given to a cut-back in production at the mines. It is evident that about a 10 per cent reduction in world output may be needed to balance present demand and supply. But in fairness this should be shared by all producers, not alone by U. S. mines. Phelps Dodge, however, made a start by announcing a cut at its own mines of 10 per cent that will reduce its output by 2250 tons a

(Turn to page 109, please)



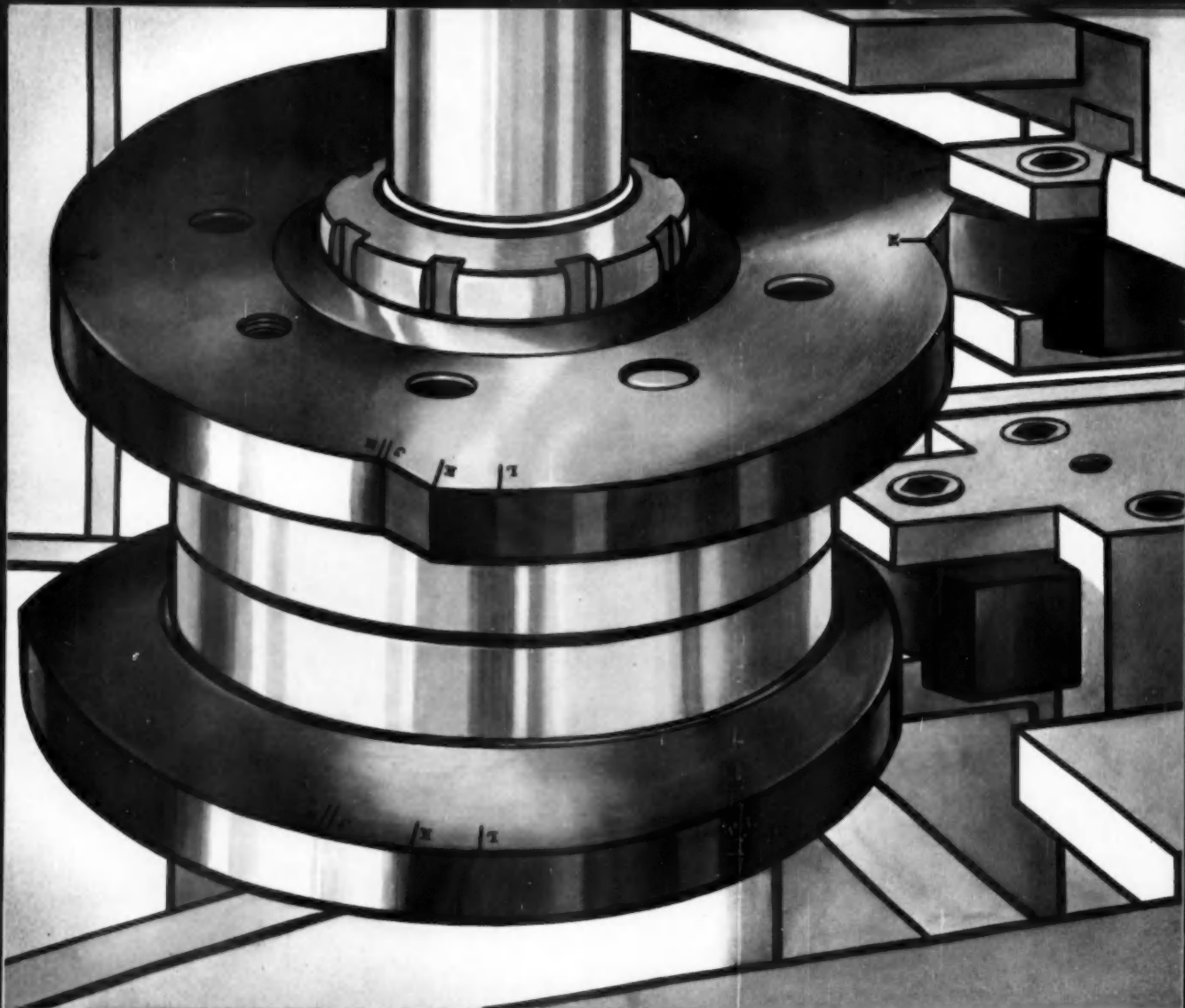
New Britain +GF+ outproduces multi-tool lathes with a single tool

How can one tool outproduce several? The answer is — maintain dimensional relationships with a template or prototype instead of a multi-tool setup. This cuts tool changeover time to practically zero.

On the New Britain +GF+ copying lathe, you can cut at maximum speeds and feeds for tool efficiency without worrying about tool wear and the delicate readjustment of several cutting tools. When the tool wears, change it, bring one dimension to size. The other dimensions have to be right. Your choice of a New Britain +GF+ means elimination of any extra operation to bring pieces within grinding tolerances.

Machines from New Britain's three machine tool divisions incorporate the *basic principles* of more profitable production.

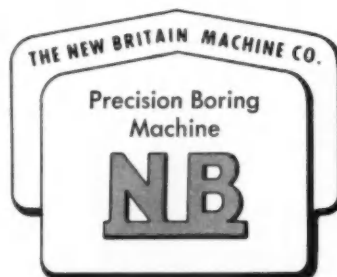




cams put the precision
in precision boring

When you are working to "tenths" cams are your best method of maintaining accuracy, because cam control of the tool is *positive* control. The accuracy of parts produced on New Britain boring machines *can't* be affected by variable hydraulic pressures, ambient temperature, or play in complicated linkages.

In boring machines or *any* machine tool investment, be sure your most important requirements are met, not by gadgets, but by the fundamental design principles employed. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



METALS

(Continued from page 106)

month. This may be followed by Kennecott and Anaconda. These three companies supply about 80 per cent of total U. S. production.

Whether such a move will be shared by foreign producers is much more doubtful. Political conditions almost certainly prohibit such a step in Chile, and Rhodesian and Congo producers are unlikely to be sympathetic. Most of Canadian copper output is by-product with nickel and cannot be curtailed without interference with production of that vitally-needed metal.

Stockpiling a Possibility

There is considerable possibility that the Government could step into the picture and take copper for the stockpile. Some domestic producers are able to put copper to stockpile authorities under contracts made several years ago when expansion was being encouraged. Contracts were made to deliver copper at 24 to 31 cents a pound but little metal was delivered because the open market price soared. Some of these contract prices carried an escalator clause covering future increases in the general level of costs. Hence copper could now become saleable to the stockpile at 28-35 cents a pound, with the bulk at 30-33 cents.

Stockpile Buying Props Lead and Zinc

Lead and zinc prices still are dependent on continued buying for the stockpile. As long as this continues it is unlikely there will be any change. But there is no assurance from Washington that its buying will be indefinitely continued. The Government took less zinc and lead in March than in earlier months. Probably decreasing amounts will be accepted unless more funds are furnished, which is not too likely in the present Congressional mood for retrenchment.

The most recent figures from the Zinc Institute show slab production at a high figure, much in excess of domestic shipments. With the Government taking in February only two-thirds of the metal accepted in January, stocks of slab increased sharply to nearly 87,000 tons at the end of the month. Lead buying is better than zinc, but the tonnage taken is not overly impressive.

Aluminum Demand Slow

Some of the difficulties that plague the copper producers are confronting

P & B STRIKE SETTLED!

AN OPEN LETTER TO RELAY USERS

Potter & Brumfield, inc.

Dear Friends:

Ruthless violence, culminating on February 13 with the shooting of the four-month-old baby daughter of two of our employees, focused national attention on a recent strike at our Princeton, Indiana plant.

This unjustified strike was called on November 5, 1956 in the face of our "no strike" contract with Local 1459 of the International Association of Machinists. No demands or proposals for settling the strike were made by the Union. Two Company proposals were summarily rejected.

Settlement of the strike was reached on February 28, 1957.

Our plants in Laconia, New Hampshire and Franklin, Kentucky were not affected by the strike.

Production lines were shifted from Princeton to both Laconia and Franklin plants, and employment has been greatly increased at both locations. These plans were made before the work stoppage to increase production.

Production at Princeton was resumed on December 17th, and today a normal work force is manning the remaining lines. Until recently, the training of new workers restricted our productivity, but output now is at satisfactory levels.

With three plants to serve you, we pledge our continued efforts to provide you with relays of the finest quality. Our Engineering Department welcomes the opportunity to work with you on new designs and future projects.

Sincerely,

Dale V. Cropsey

Dale V. Cropsey
Vice President & Director of Sales

NOW!
3 PLANTS TO
SERVE YOU

POTTER & BRUMFIELD, INC.

PRINCETON, INDIANA A Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

the aluminum companies—too much production, less demand than expected from consumers. The official price of 25 cents a pound for pig, 27 cents for ingot, is more honored in the breach than in the observance. Primary metal has been bought by dealers at 23 cents. Prices abroad have weakened under offers of Russian aluminum.

Reflecting the general hesitation in the market, prices for extruded shapes were cut six per cent by Revere Copper & Brass, and followed by other producers. Two of the major companies, Reynolds & Kaiser, put 40,000 tons to the Government for de-

livery in the first quarter. This was somewhat unexpected as power shortages had cut down output in the northwest and it was thought this would relieve oversupply.

Yet there is no thought that the long-term outlook is anything but rosy. Indicative is decision of Reynolds to start construction of a new 100,000 ton reduction plant to cost \$88 million and approval of a power contract in conjunction thereto. An aluminum casting foundry for automotive parts will be built close to the plant by General Motors, its second venture into the field. Abroad, foreign

interests have engaged in a huge project to erect an aluminum plant to produce 480,000 tons a year, utilizing the abundant bauxite deposits in the French Cameroons. Initial production this year will be 10,000 tons.

Titanium by Continuous Process

An important announcement by Kennecott Copper and Allied Chemical suggests that lower prices for titanium metal are on the way. These companies will be the first to produce titanium on a continuous basis, and will invest \$40 million in facilities. Production of titanium tetrachloride, sponge, and ingots will start in 1958. Titanium slag will be employed as the raw material instead of imported rutile. In line with this, Quebec Iron & Titanium, a Kennecott-N.J. Zinc subsidiary, will increase its production of slag by 60 per cent at the company's processing plant at Sorel, Quebec.

Sandwich Structure

(Continued from page 72)

high grip strength rivets and where basket nuts, nut plates, or Rivnuts, are used, may allow certain of the panels to be demountable. Its main disadvantage is the fact that a box-like configuration using this type of joint will lack torsional stiffness at the open end. This may be alleviated, in some measure, by the application of angular or gusset-like stiffeners to the corners of the open end.

Figure 15 shows a design embodying a specially extruded edge member which has been used where high internal or external pressure is present and where demountability is required.

The special extrusion shown in Fig. 16 is a modification of the T-extrusion shown in Fig. 14. While offering more structural integrity than the simple T-extrusion it has the disadvantage of making both of the panels critical in thickness. Panels must have edge fillers in areas where riveting is to be accomplished, because "bucked" rivets would bend in hollow core and no head would be formed.

Joints which utilize formed sheet metal shapes or standard extrusions are illustrated in the following figures:

Figure 17 shows the double angle

it's your move!
WAUSAU

HAS THE INSERTS...



No. 2 Developed especially for die-cast aluminum alloy engines. Similar expansion characteristic holds seats tight in block.



No. 7 High chrome content hard seat for heavy duty gasoline engines. Economical, but high in impact and corrosion resistance.



No. 3 Premium quality cobalt tungsten chrome alloy for Diesel and gasoline engines. Dissipates heat, will not crack or loosen, high corrosion resistance, high impact resistance.



No. 1 Molybdenum alloy cast iron seat provides strength at low cost. Easily adaptable to air-cooled engines and tractors.



No. 4 Highest quality bi-metal seat. Standard of quality for almost every heavy duty engine application.

You can "move" in any direction in this line of valve seat inserts... choose from special alloyed cast iron, alloyed steel, bronze or bi-metal in flange, throat, threaded or conventional designs. Whichever way you "jump" you land safely with a valve seat proved in service by scores of leading engine builders who have specified Wausau inserts for many years. Metallurgical and design data on request.



WAUSAU MOTOR PARTS CO. • 2200 HARRISON ST. WAUSAU, WIS.

method of joining. Where semi-hollow steel or aluminum rivets are used, no edge member is necessary.

Note that the joint shown in Fig. 18 employs panel edges as noted in Figs. 7 and 10, and also that the flat facing of the Fig. 10 type panel is protected from peeling forces.

Figure 19 employs an angle and Z-section in joining. This method generally utilizes edged panels and is disadvantageous in that the thickness of the lower panel and the height of the Z-section must be held to close tolerances.

Figure 20 illustrates a simple method for edge joining of panels, using milled sections of solid bar stock.

The configuration outlined in Fig. 21 is fabricated by routing away the inner face and core material, and folding inward to form a corner. This type of corner is used where loads are light—in such applications as equipment covers.

In panels where lengths or widths exceed the limits of standard sheet sizes, splices may be made in the facings as shown in Fig. 22. The blind rivets shown are optional and are used only where high local loads are expected.

The doubler in Fig. 23 may be crushed into position where low density core sandwiches are to be cured in a platen press. Where high density core materials are used, the core must be routed out. The facing splices may be prefabricated by bounding and riveting, if a flush surface is required.

BOOKS...

HOW TO GET INDUSTRIAL AND BUSINESS PUBLICITY, by C. E. St. Thomas, published by Chilton Co., 56 E. Chestnut St., Philadelphia 39, Pa. Price, \$5.00. Using the step-by-step method, this book attempts to explain how to organize and run a publicity department. The author addresses himself particularly to smaller firms which are most likely to get direct results from good publicity. He has outlined the job of setting up a new publicity operation from the ground up—including the actual physical layout of the office to contacts with the press. He also discusses such important matters as the publicity man's relations with key people in the firm, his participation in company meetings, and his relations with the press itself. Altogether, an extremely valuable book for business executives and others who are interested in effective publicity methods.

Four New Firestone Plants In Works; Others Improved

Four new manufacturing plants, costing approximately \$30 million will be completed by Firestone Tire & Rubber Co. during the next few months. In addition to the new plants under construction, Firestone is going ahead with extensive expansion, modernization, and improvement plans in many of its existing plants.

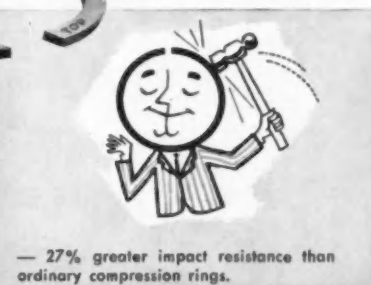
The new plants scheduled for completion between now and October are a butadiene manufacturing plant at Orange, Tex.; a tire plant at Havana, Cuba; an air springs plant at Nobles-

ville, Ind.; and a tire plant in Manila, Philippine Islands.

The expansion, improvement, or modernization programs are underway at Firestone plants at Pottstown, Pa.; Lake Charles, La.; Akron, O.; Fall River, Mass.; Los Angeles, Calif.; and Des Moines, Iowa, in the U. S. Plants in Brentford, England; Buenos Aires, Argentina; and Port Elizabeth, South Africa, are also scheduled for renovation.

A multi-million dollar expansion program has also been announced for Firestone's Hamilton, Ont., plant. Construction of the new facilities is expected to begin immediately.

another good move ... SPECIFY **WAUSAU** HT-100, the "HE-MAN" COMPRESSION RING



For heavy duty commercial vehicles and engines subjected to heavy work loads under difficult operating conditions . . . this is the ring you want. Produced from an exclusive alloy formula HT-100 is a "he-man" of a ring . . . a "brute for punishment" . . . able to function effectively under almost unbelievable conditions. Remarkably tough yet "smooth as silk" HT-100 reduces cylinder wear while at the same time sealing effectively. Write for Technical Bulletin #100.

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"ENGINEERED" JOB #1082



SOLUTION—

One, standard design, Murray-Way ten station indexing dial-table, with special features.

Eight, universal floating type, Murray-Way polishing heads, with special overhead mounts.

One, special Murray-Way engineered control system.

Ten, Murray-Way designed mounting fixtures.

RESULT—A high production, easily operated polishing set-up with a minimum of occupied floor space. Retractable heads for convenient wheel change. Overhead, head-mounts afford maximum open floor space. Push button controls. A unique, automatic wheel-pressure hunting device. Sturdy dial-table with oversize center-bearing and special anti-friction, hardened rollers for outside support, to reduce wear. Automatic indexing mechanism with Murray-Way for easy interchange of fixtures and parts accommodating a wide variety of work.

You too can profit by the combination of Murray-Way's time-tested line of equipment and Murray-Way's specialized engineering. We'll gladly discuss your buffing, grinding and polishing problems.

MURRAY
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P. O. BOX 180, MAPLE ROAD EAST • BIRMINGHAM, MICH.
Polishing, Buffing, Grinding, Filtering Equipment that automatically cuts costs.

PROBLEM—A special, automatic indexing, polishing set-up for minimum floor space to meet high production. The equipment with a minimum of service requirement. The equipment to be easily converted to other uses as required.

AUTOMATION News Report

(Continued from page 65)

previously was held on ten file shelves; and

Reduce by 85 per cent over the next year visible records now kept on about 10 million file and punched cards, metal plates, and hand written sheets.

Four basic types of equipment in 220 units comprise the integrated Bizmak system. Input devices prepare and feed information and instructions into the system. Storage units file data on magnetic tape reels for ready accessibility on demand. Processing units sort and compute data according to specific requirements. Output equipment translates the data assembled by the other units into punched paper tape or printed form. Speed of the electro-magnetic printer is 600 lines a minute, or more than 100 times faster than a standard teletype machine.

Daily reports from field depots are received over leased telephone lines and converted directly to punch cards, which are then started through the system.

Centralized control of the complex system makes possible unattended operation of most units. From a control room, operators can link any one of the 182 magnetic tape storage stations which now hold 100 million facts, with the appropriate processing machine for automatic operation. Tell-tale flashers indicate which units are available for use.

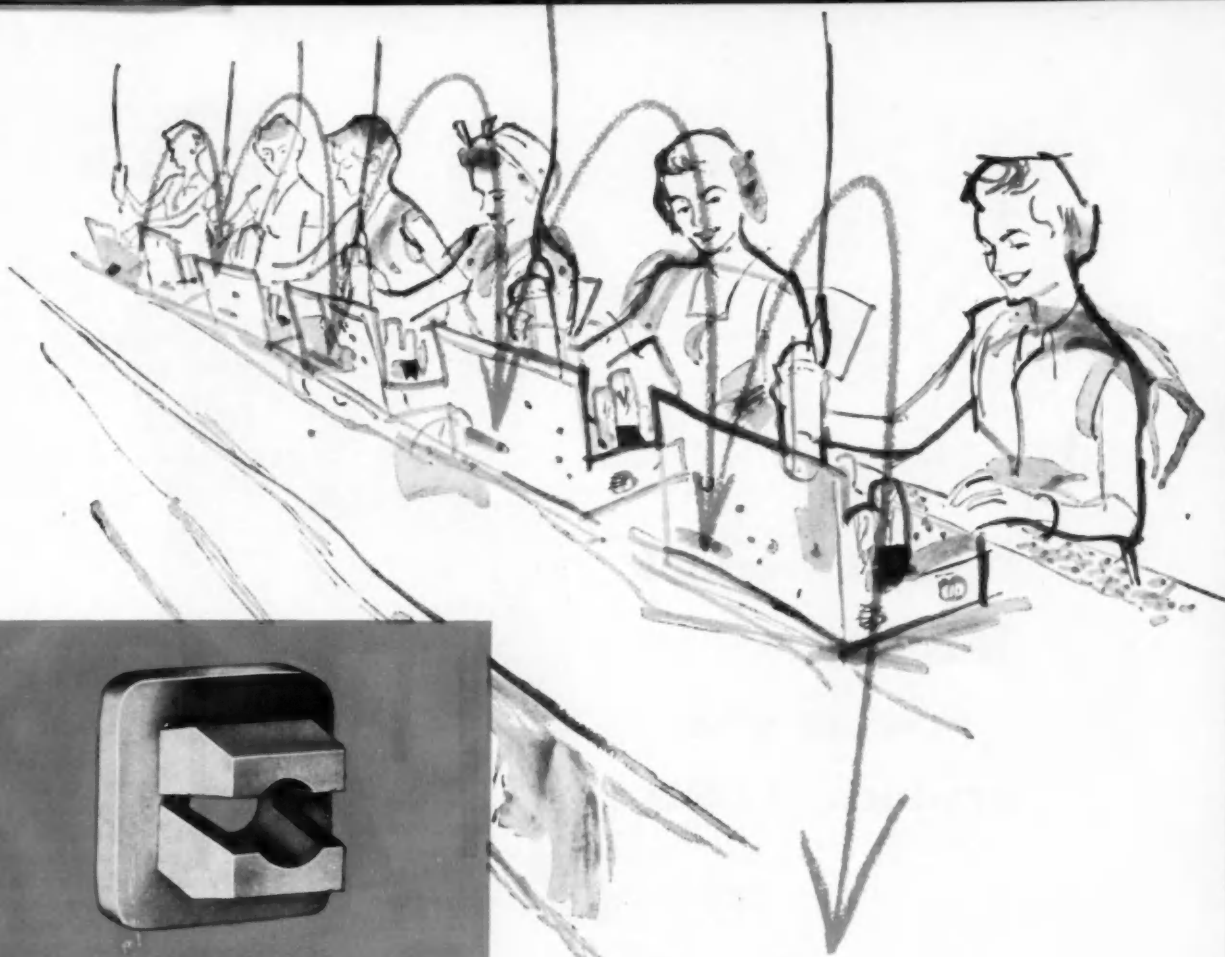
Total cost of the installation is about \$96 million, including alterations necessary to the building. High heat generation required 250 tons of air conditioning equipment. OTAC estimates that the cost will be saved many times over each year, however, because expense of maintaining inventory would be reduced several million dollars annually.

AUTOMATION CONGRESS

An international Automation Congress will be held in New York City, June 9 to 13, 1958, as an adjunct of the Fourth International Automation Exposition. The Exposition will be held in New York's new Coliseum during the entire week.

Already planning to attend are makers and users of automation from most of the mechanized countries of the world, who expect to exchange ideas and information. Many of these experts will assist in providing guidance for the less well-informed who will be present.

(Turn to page 115, please)

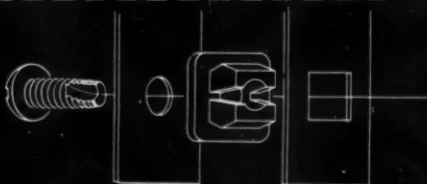


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- available in any color

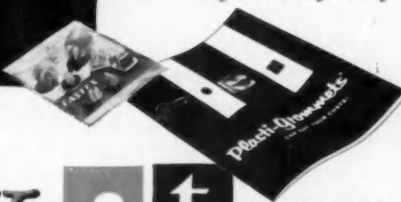
35 sizes stocked



... An Easier Way to Speed Production

... and cut assembly costs, too! Plasti-Grommets snap into a prepared hole at the touch of a finger ... replace other costly retained threaded receptacles, tapped holes or retained nuts. Locked in place by a thread-cutting screw, Plasti-Grommets provide a firm, durable, vibration-resistant fastener. Developed at the Fastex creative engineering labs, Plasti-Grommets are a typical example of the simplification possible in multi-part assembly operations. Fastex volume production of metal and plastic components—on specialized manufacturing equipment—increases the economies gained through Fastex engineering ingenuity. These savings are being realized today in nearly every mass-production industry.

Test Plasti-Grommets®... send for informative brochure and free packet of these remarkable nylon blind screw receptacles... actually test them... see how they can reduce your costs!



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**don't overlook
this way to
save on your
production costs**



Typical application of OK Wear Plates on automotive die.

OK aluminum bronze wear plates for cam dies are now being used by the majority of appliance builders and automotive body makers. Here's why: You save approximately 40% under the cost of expensive solid bronze wear plates . . . and you receive completely finished wear plates, available from stock, ground to $\pm .0005$ parallel and flat. By a unique cladding process, long-wearing aluminum bronze is bonded to a steel base, easily machinable for fitting

to dies. Drilling or counterboring can be done through bronze surface if required. Wherever your die has a sliding or cam action, you'll achieve finer results with OK aluminum bronze wear plates. Complete information is contained in our new OK Catalog. For your free copy, write Dept. 58-AB.

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SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES • SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

AUTOMATION News Report

(Continued from page 112)

Precise formulation of the Automation Congress agenda will require additional months of correspondence. Already included are an extensive series of conferences, clinics and meetings which will be integrated with the exhibits to be displayed at the Fourth International Automation Exposition.

Management for the Fourth International Automation Exposition as well as for the associated events of the international Automation Congress will be Richard Rimbach Associates.

Automatic Machine for Drilling and Riveting

(Continued from page 64)

lic devices.

Rods of 2024 aluminum alloy are cut to rivet length with ends squared and chamfered. Slugs are then heat-treated and stored at -20 F. They must be driven within 20 min after exposure to room temperature.

Rivets are first squeezed and then vibrated, the Drivmatic machine performing both operations. Vibration is controlled automatically by a number of electrical settings. Rivets can be inserted in restricted holes, since the machine applies a 1500 lb insertion pressure.

Components of the Drivmatic machine are supported or enclosed in a steel C-frame, 12 ft high with a 10 ft jaw depth. The lower ram of the C-frame heads the bottom of the slug rivet, provides the high-pressure clamp, and incorporates a unique profiling mechanism which automatically controls the edge distance along the stringer. The upper head of the C-frame contains the drill spindle, mill spindle, and rivet gun with injector fingers.

A handling frame, to which the wing panel is attached, guides and delivers the workpiece to the exact drill and rivet location, and can move in the vertical, transverse, longitudinal and radial planes. Control of each extremity is independent of the other, permitting the workpiece to be located in any desired position.

**AUTOMOTIVE INDUSTRIES
KEEPS YOU INFORMED**

AUTOMOTIVE INDUSTRIES, April 1, 1957



Automobile manufacturers can get back part of the excise taxes paid the Government on oil purchases. A new ruling by the U. S. Court of Claims entitles the makers to recover taxes paid on oil in completed cars at the time they were sold.

Pressure for tax cuts to aid small business is building up in Congress. The lawgivers could go either way this year.

Business outlays for new plant and equipment appear headed for a new high in 1957. Expenditures of this type are scheduled at \$37.4 billion, according to a survey by Commerce Dept. and S. E. C. The figure would be 6½ per cent above the previous record set in 1956. The \$35.1 billion total last year was 22 per cent above business spending for expansion in 1955.

Commerce Dept. is hoping to get the tax write-off goal for commercial aircraft reopened and increased to include a "large number" of jet transports. Office of Defense Mobilization will make the final decision.

Boosted firepower, not greater numbers, will typify Air Force fighter planes in the future. Most of the service's cutback to 128 wings will be in fighter and fighter-bomber wings.

Internal Revenue Service officials are reviewing the 15-year-old schedule of useful lives of depreciable property. Results of the study could mean important tax savings to business.

Improved cost control within the Army and Navy is beginning to pay off. Savings to taxpayers resulting from tighter cost control amounted to millions of dollars in 1956.

Quality



*that protects
your company's name...*

There is no substitute for quality whether you are interested in the components, the workmanship or the end product you manufacture.

One of the basic components of almost every industry is fasteners. Successful operations that cash in on every opportunity for faster assembly utilizing maximum worker output with minimum loss of materials—find that quality fasteners such as Southern Screws form a dependable foundation for profitable production.

Although Southern has earned for itself an enviable reputation for fast service, and its stock of over One Billion fasteners—Quality is the benchmark of Southern products... constant quality that has become synonymous only with U. S. A.-made fasteners produced by U. S. A. workers.

If yours is a quality product, protect your company's name with Southern fasteners. Southern makes every screw it sells! Wide variety of head styles, materials, and finishes...

Write for samples, Stock List and Regional Stock Guide, Box 1360-A1, Statesville, North Carolina



Wood Screws • Machine Screws & Nuts • A&B Tapping Screws • Stove Bolts • Roll Thread Carriage Bolts • Dowel Screws • Hanger Bolts • Wood & Type U Drive Screws

Warehouses:
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WANTED TRUCK and BUS Engineers

Engineering Executive Assistant—\$16-\$20,000

GRADUATE M.E.—Age to 45. Require cognizance of engineering trucks and buses and heavy automotive equipment. Administrative experience in design and development. Location Pennsylvania.

Executive Engineer— \$14-\$18,000

GRADUATE M.E.—Age 35 to 45. Capable of directing staff in design of heavy duty automotive transmissions, differentials, axles, et cetera. Greater New York area.

Director of Research

GRADUATE M.E. or M.M.E. Age to 44. Background experience in heavy automotive equipment, substantial knowledge of metallurgy. Location New Jersey. \$11-\$14,000.

One Senior Transit Bus Engineer

38-42 years—\$11-\$12,000.

One Senior Truck Engineer

38-42 years—\$11-\$12,000.

Two Truck Engineers

Brakes, chassis, etc.—30-35 years—\$9-\$10,000.

Two Bus Engineers

Body, chassis, suspension. 30-35 years—\$9-\$10,000.

Two Junior Experimental Engineers

Trucks—\$7,500.

Two Junior Experimental Engineers

Buses—\$7,500.

One Junior Electrical Engineer

Automotive (Exp. Delco, Remy or Autolite—five years experience) \$6-\$7,500.

Send resumes to:

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521 Fifth Avenue
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One new V-8 engine was tested more than three million miles under all conditions before being put into production.

Today's automobiles carry as many as 13 electric motors.

Courses in motor fleet supervision and maintenance have been held in 34 U. S. universities.

Wing tanks of a luxurious new U. S. airliner hold 9600 gal of fuel—enough to supply a 40,000-lb trailer truck for 14 months.

In the engine of an eight-cylinder car, traveling at 50 mph, 136 spark plug firings take place every second.

Between four and six grades of petroleum fuel have to be stocked to service all types of aircraft using major international airports.

Gasoline sales account for about 70 per cent of the dollar volume done by the average service station.

By 1956, farm output per man-hour is expected to rise 40 per cent

Every minute of today, about 105,000 gal of gasoline are being used in the nation's vehicles, planes, tractors, boats, and industrial engines.

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SAVE up to 50%

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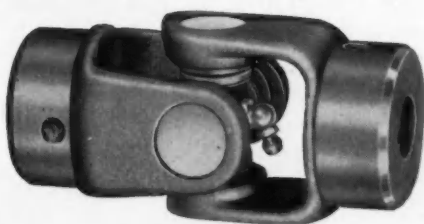
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What Are **Your** Special Universal Joint Requirements?

Anything from a heavy duty close coupled double universal joint like the one pictured above to a small power take-off joint (shown below) is right down "Cleveland's" alley. Limited joint length and diameter can probably be met with standard "Cleveland" components—and at a substantial saving to you.



Look to "Cleveland" for propeller shaft and universal joint requirements. We've been suppliers to the automotive and allied industries since 1912.

Cleveland Steel Products Corporation

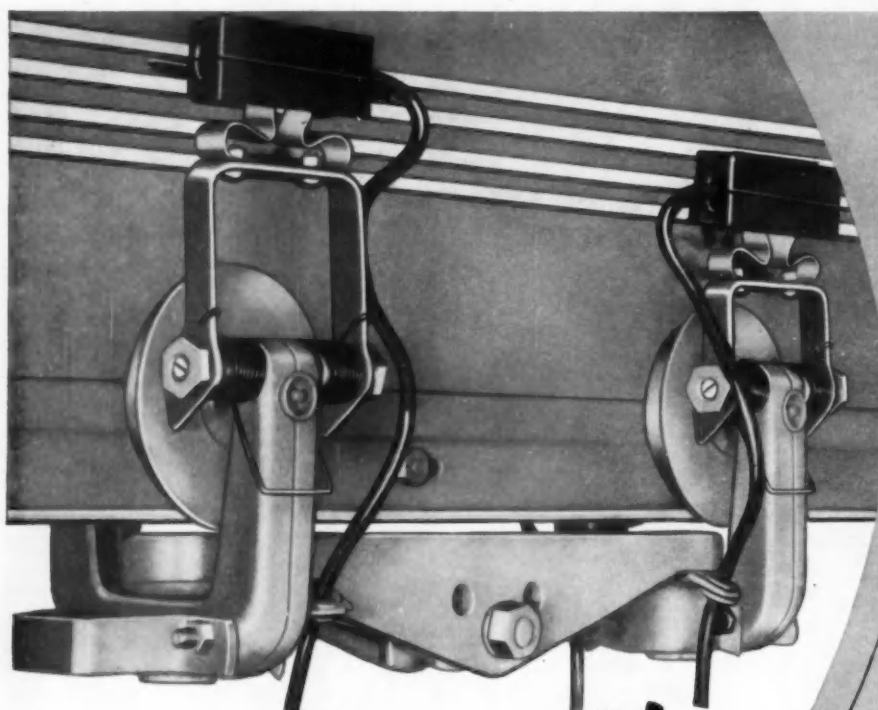
Automotive Division

16025 Brookpark Road • Cleveland 11, Ohio

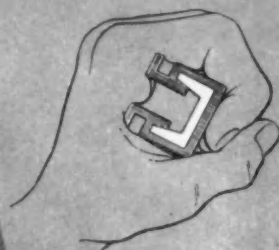
Manufacturers of



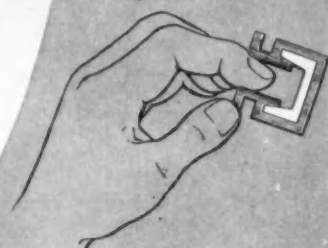
**Universal Joints • Propeller Shafts
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NEW! SAFE!



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fingers cannot enter

AMERICAN MONORAIL
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SHIELDED ELECTRIFICATION
For Monorail Track and Crane Systems

By covering its standard bus bar electrification with a specially designed polyvinyl chloride extrusion, American MonoRail now furnishes completely safe electrified systems.

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A new type sliding shoe collector provides a floating contact throughout a monorail system regardless of any misalignment due to bent bars or at switch and inter-lock connections.

KANT-SHOCK Electrification positively eliminates all the hazards of open bar conductors—prevents costly accidents—protects employees—reduces insurance rates.

Write for KANT-SHOCK Bulletin KS-1

Member of Materials Handling Institute and Monorail Manufacturers Association
 For Power Driven Conveyors, Use Landahl Chainless Conveyors

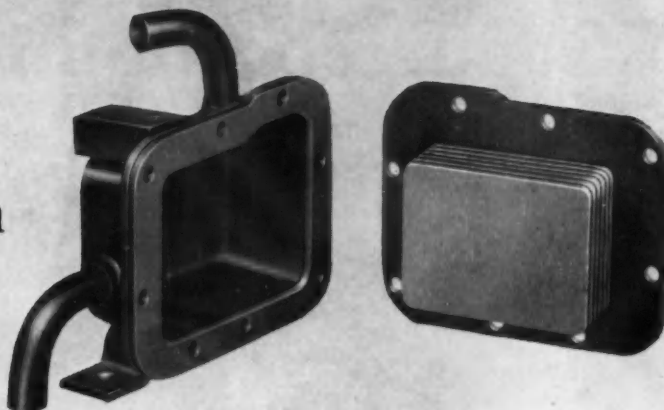


AMERICAN

MONORAIL COMPANY

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Better Engine Operation with Oil Coolers



Heat dissipation in limited area accelerated by new, plate-type unit

The ever higher performance being built into modern engines is creating new problems in heat dissipation. Engine efficiency, pressures and operating speeds have increased. So have operating temperatures of the engine parts. But the surfaces and area available for dissipating heat may be unchanged or even smaller. Therefore, more heat is drawn into the lubricating oil of the engine.

Although friction losses in percent of total power output are dropping, the absolute rate of heat generated has gone up. This heat may exceed temperatures which the bearings are designed to resist and may rise to destructive levels.

In commercial vehicle, marine and industrial engines, heavy work loads are usually frequent or constant enough to require an oil cooler to maintain viscosity and to augment heat rejection. Such a unit may be attached to the engine or built into the engine block.

LARGE CAPACITY IN SMALL UNIT

To facilitate concentrated heat dissipation in a small space, Long Manufacturing Division of Borg-Warner Corporation has developed a compact, plate-type heat exchanger with large heat rejection capacity for its size. The unit is applicable on or in any engine requiring lubricant cooling. Current applications extend to 400 bhp/pm. The element's rectangular shape is proportioned to be readily adaptable to a small aperture in the block where water can be circulated.



Photo courtesy Gray Marine Motor Co.

The Long engine oil cooler, installed here on a new marine engine, is small, unobtrusive, easily accessible.

It can also be used for any oil cooling application, such as in transmissions, torque converters and hydraulic presses.

The high efficiency of this cooling element lies in the diagonal flow path of the oil across the plates, utilizing the maximum possible length of the unit. Location of the fittings gives high velocity turbulence and effective oil distribution.

Spacers are placed between the plates to allow free circulation of the cooling water around this core. The assembly is then brazed into an integral structure. Counter-flow paths of the oil and water assure maximum heat exchange efficiency.

The turbulators are designed to minimize the pressure drop across the plates. Ingenuity in designing flow paths and stack arrangements of a single design element, according to the operating requirements, contributes to the economy of the unit. Any reasonable number of plates may be assembled in parallel, in series, and in parallel series.

RUGGEDNESS AT LOW COST

Manufacturing the casing (in accessory applications) from steel stampings instead of fabricating it from castings is a unique, cost and weight saving feature. Paint protects the exterior while the waterside is clad with rust- and corrosion-resistant cupronickel. The plate shells enclosing the mild steel turbulators are formed from stampings of solid cupronickel.

On the waterside this heat exchanger may be readily cleaned and the multiple-plate core can be removed from the casing without disturbing the water connections.

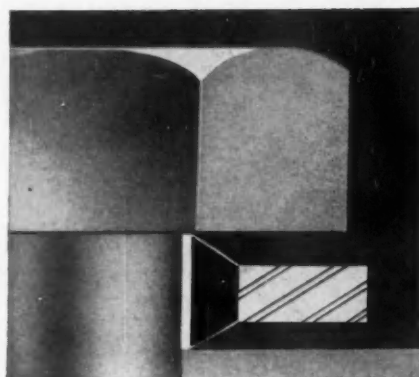
Traditional Long engineering and craftsmanship assures the quality, efficiency and dependability of this oil cooler. It is the first in a series of new products from this 53-year old manufacturer of heat exchangers, clutches and torque converters.

An engineering bulletin, including basic heat transfer and pressure drop charts from performance tests at Long Laboratories, may be had on request. The data also lists information requirements for obtaining recommendations on specific applications of this and other types of oil coolers.

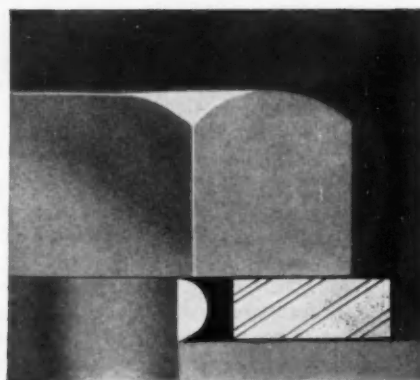
Write to Dept. OC 1, Long Manufacturing Division, Borg-Warner Corp., 12501 Dequindre Street, Detroit 12, Michigan. In Canada: Long Manufacturing Company Limited, Oakville, Ontario. Export Sales: Borg-Warner International, 36 South Wabash Street, Chicago 3, Illinois.

Another new development using

B.F. Goodrich Chemical raw materials



Seal before compression



When bolt is tightened, sealing lips are forced against surface.

Hycar rubber bonded to steel solves sealing problems

FACED by a sealing problem with water, gases, chemicals, petroleum products or other fluids? Then listen to this:—

The Precision Rubber Products Corporation of Dayton, Ohio, has come up with a one-piece seal using Hycar nitrile rubber that gives positive sealing action against constant or pulsating pressures up to 10,000 psi!

The Hycar is heat and pressure-bonded to a steel washer to become the sealing member. When compressed, it supplies lock washer action and reduces bolt torque. Under any type of flange, bolt or screw, it

gives leak-proof sealing. What's more, it eliminates costly groove cutting or machining of surfaces.

Hycar was specified for this new product because it keeps its shape, strength and flexibility... is far superior to general purpose rubber in resistance to oxidation and aging. And it has exceptional resistance to the deteriorating properties of a wide range of fluids and gases, temperatures and pressures.

Throughout industry, Hycar's remarkable qualities are improving existing products or are providing the inspiration to create new products. For complete information on how

one of the Hycar rubbers can do this for you, too, write Dept. HJ-2, B. F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar
Reg. U.S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company



GEON polyvinyl materials • Hycar American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors



How Mayari R thwarts corrosion in these refuse loaders

Ashes, rubbish, garbage, boxes, crates, even Christmas trees — all are gobbled up and chewed to a pulp inside the cavernous bodies of these welded Roto-Pac refuse loaders. What a happy hunting ground for corrosion and abrasion!

City Tank Corporation, Corona, L. I., N. Y., makers of Roto-Pacs, stave off corrosion and abrasion by building the sides, roof and floor of the body with Mayari R high-strength, low-alloy steel. Mayari R resists abrasion substantially longer than carbon steel, and has five to six times greater resistance to atmospheric corrosion. It also welds just about as easily as carbon steel.

These three properties have led many vehicle manu-

facturers to take advantage of Mayari R in building their product. So has its high yield point (50,000 psi for material up to and including $\frac{3}{4}$ in. in thickness) which permits the use of lighter structural members for sizable reductions in deadweight.

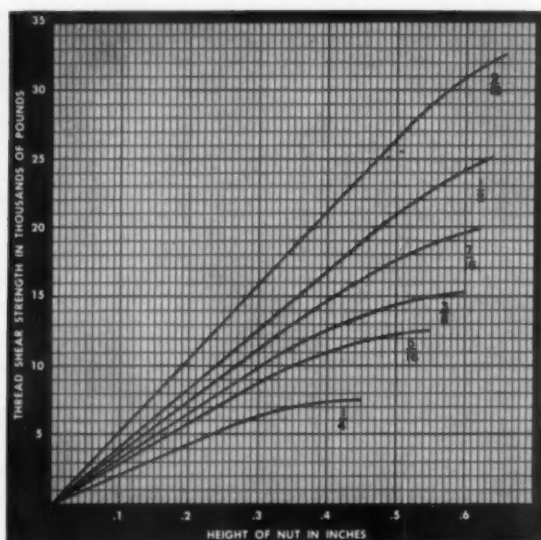
Catalog 353 contains important technical data on Mayari R, as well as scores of illustrated case histories on specific Mayari R applications. If you would like to have a copy, just telephone or send a letter to the nearest Bethlehem district sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem
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Mayari R...High-Strength, Corrosion-Resisting Steel



Shear Strength...

Finished HEXAGON NUTS fine and coarse threads

The above curves show how the proof load of a nut (the load causing the threads to strip) varies with its height. (The curves do not account for bolt characteristics or fatigue and safety factors.)

If you are buying load carrying capacity, the curves suggest that it may be more economical to:

1. Use a thicker nut—
2. Increase the fastener size—
3. Use more and smaller fastenings—
4. Use heat-treated nuts to develop full bolt strength (heat-treating increases nut proof load 30 to 50% over the above values)—

Variables of economical fastener design selection and assembly are discussed in the Engineering Data section of our catalogue that we will send upon request.

**NATIONAL
MACHINE
PRODUCTS
C O M P A N Y**

Manufacturer of Standard and Special #12 Pointer and Hexagon Nuts... "Huglock" and "Marsden" locknuts,
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PAINT PUMPS

for economical,
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of paint directly
from original drums
to one or more
spray guns

Save labor, time and materials plus lower paint handling equipment cost!

No time lost in transferring materials.

No messy floors or refill containers.

2 to 1 ratio pump handles all types of paint.

Automatically adjusts for variation in drum height.

Completely empties the drum.

Ruggedly built yet easily handled—weighs only 20 pounds!

Consult your classified directory for nearest Paasche representative or write for complete information.

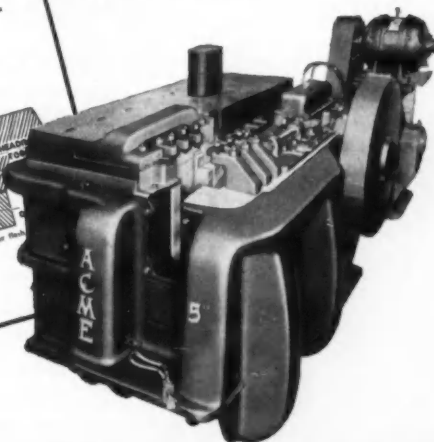
PAASCHE AIRBRUSH COMPANY

A DIVISION OF CLINE ELECTRIC MANUFACTURING COMPANY
1909 WEST DIVERSEY PARKWAY • CHICAGO 14

helpful suggestions

FOR MODERN FORGING PROCEDURE

You are invited to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods and procedures. We will be glad to send a complete set of all sixteen issues of "The Forger" in addition to placing your name on our mailing list to receive future articles as they are prepared. There is absolutely no charge for this service. We are glad to make this good will contribution to the advancement of modern forging practice as executed on ACME XN Forging Machines.



MULTIPLE OPERATION OFFSET FORGINGS

The problem of making a forging having the operation offset from the center line of the blank is an interesting project. A description of dies to produce a forging of this type, with a minimum of flash or waste, may be helpful to the reader.

When upsetting a piece of round stock it is a well-known fact that the material will be equally distributed around the circumference, increasing the diameter.

It also has been observed that when upsetting square or rectangular stock, the upset portion has a tendency to form a circular shape.

With these facts in mind, it can easily be seen that if an offset forging is formed on the end of a bar without first gathering the material in an off-center position, but then upsetting the material, the offset will be lost.

It is not difficult to see that the offset will be lost if the upset is made on the end of the material. An examination of the dies in the accompanying illustrations will indicate a method of overcoming the irregular flash by initially affecting the forging from its end.

Sketch "A" shows the different steps necessary to form a crankshaft.

Item #1 shows the portion of the blank that is heated, having the front end cold. The cold end will retain any tendency of metal flowing around the heating end.

Item #2 shows the blank bent or offset, while item #3 illustrates the upset metal.

The bending as illustrated in item #2 and the upsetting shown in item #3 are accomplished in a single operation.

By using offset dies as shown in Figure "B", the blank will be offset by the closing of the dies and the advancing of the material back into the cavity.

The offset cavity should be designed so as to leave a landing and prevent the material from flowing into a flat.

The offset cavity, thereby eliminating any chance of a flat landing in the next operation.

Item #4 illustrates the completed forging with flash, forming in the next operation.

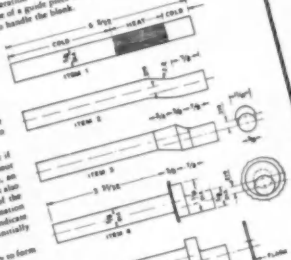
This offset blank is formed in a cavity in the landing tool, which is set in place for possible overflow or flash.

Item #5 illustrates the completed crankshaft forging, with the flash removed. This is done in the third cavity of the dies by pushing the forging through the trim-

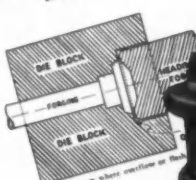
ming insert.

Figure "B" shows a set of dies used to form the crankshaft as described above. Upon examining this you will note a backing which has two functions: first, as a guide for positioning the crankshaft end, second, as a guide for locating the offset so that the landing end in the second

operation will match the offset. This is effected by the use of a guide piece that is welded to the offset end and to handle the blank.



OPERATIONS TO FORM CRANKSHAFT SKETCH "A"



4. Allow flash room where overflow or flash

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio
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"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES



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to work
for YOU...**

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He knows how to make leaf springs serve your purposes better, more economically. He knows more answers than there are in the book — because he has all the Tuthill know-how gained in 76 years of building and improving leaf springs and their application.

ASK HIS ADVICE . . . without obligation!



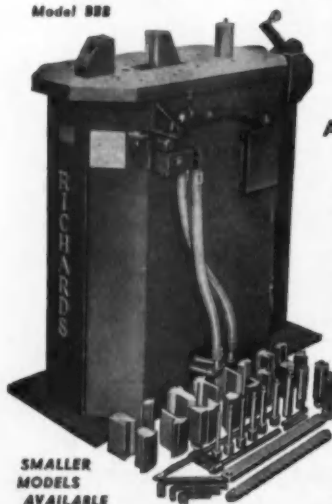
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760 West Polk Street, Chicago 7, Illinois

Multiform

BIG BROTHER BENDER

Model 888



SMALLER
MODELS
AVAILABLE



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender.

AIR OPERATED MODELS IN FOUR SIZES

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches — punching and blanking dies extra. Will punch holes up to 1" and form material up to 1/4" thick by 4" wide. We also build smaller models, hand or air operated, for bending materials up to 1/8" x 1 1/2".

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STAMPINGS

Produced economically in our modern plant for:

AUTOMOTIVE, INDUSTRIAL EQUIPMENT, AIRCRAFT, AGRICULTURAL INDUSTRIES AND OTHERS; will boost your output at material savings.

Our production, engineering and tool-room facilities are geared to the volume usage of your industry.

Send us your inquiries

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ESTABLISHED 1914



GETS-A-LITE GUARD and GUIDE **Quickly and Easily Installed by** **Anyone — No Tools Needed!**

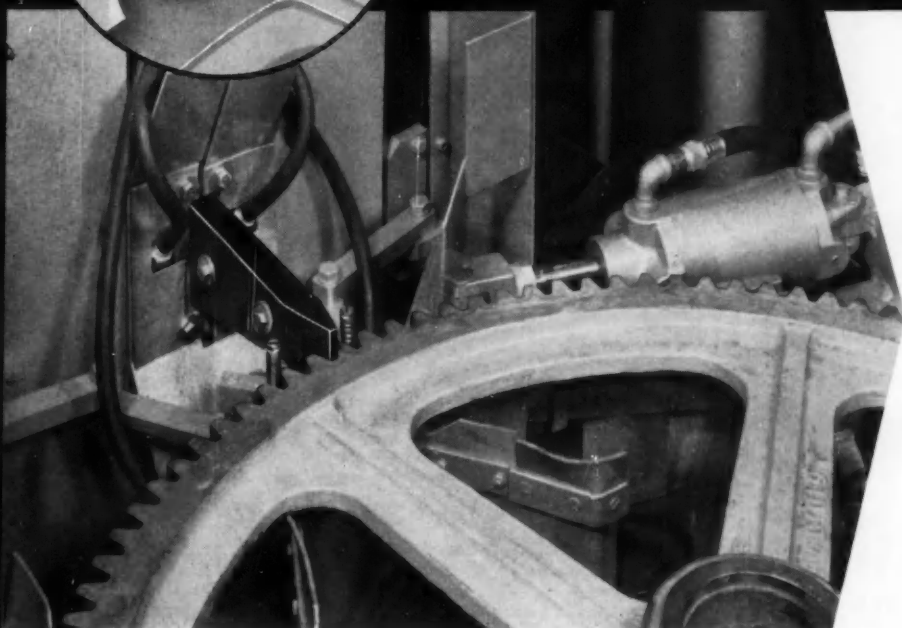
- Simply slip GETS-A-LITE GUARD AND GUIDE over the fixture, as illustrated.
- Made of indestructible spring steel wire. Nothing to break, get out of order or replace. Will last indefinitely.
- Once installed, GETS-A-LITE GUARD AND GUIDE is NEVER removed.
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- GETS-A-LITE GUARD AND GUIDE actually steers lamp into socket, enabling maintenance man to change lamp in 10 seconds!
- Available for 40 watt and 100 watt fluorescent lamps.

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3865 N. Milwaukee Ave., Chicago 41, Illinois

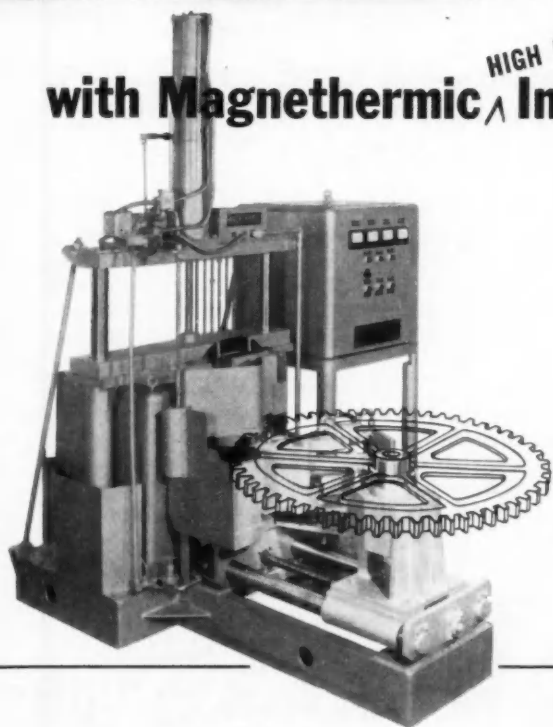


LOOK TO THE ROOT

FOR IMPROVED GEAR PERFORMANCE



tooth by
tooth
Gear
"Hardening"



with Magnethermic ^{HIGH FREQUENCY} Induction Scanning Equipment

Heat treating the critical root zone makes an appreciable difference in physical properties and fatigue strength.

With high frequency induction heating, the tooth can be full hard for maximum wear resistance. Large gears can be hardened with small capacity equipment.

Scanning eliminates the need for inductor change with varying gear face widths. Automatic controls, including indexing and quenching, result in a high production rate and uniform results.

This is one type of gear hardening. Size and production rate dictate to a great degree the type of equipment. Whatever your need in gear hardening or other heating applications, Magnethermic's experience with induction heating can be useful.

Prompt response to your inquiry — Magnethermic, Youngstown, Ohio.

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for Induction Heating



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New B&D Heavy-Duty Drills

... obsolete any drills you've ever tried

Full-power reversible feature built in at no extra cost!

Now, Black & Decker brings you the world's most powerful drills, built to a new design concept that obsoletes *all other drills* of similar rated capacity.

Brilliant, new B&D-built motors give them twice the power of their predecessors. They have *full* power in either direction. New positive key-drive chuck can't come off when tool is reversed—yet is disassembled in seconds. New, longer handles give you easy control even at maximum torque!

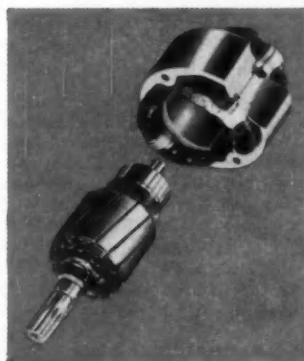
And these new tools are versatile! Their tremendous power makes it possible to use them as power units for construction elevators, speed reducers, chain and winch hoists and scores of other applications! Available in $\frac{1}{2}$ ", $\frac{3}{8}$ " and $\frac{1}{4}$ " models. Ask you nearby B&D distributor for a demonstration. Or write for complete details to: THE BLACK & DECKER MFG. CO., Dept. 1404, Towson 4, Md. (In Canada: 80-86 Fleet St., E., Toronto 2, Ont.)



Leading Distributors Everywhere Sell

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Portable Electric Tools—Power-built to set the pace



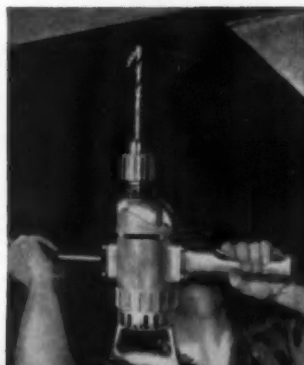
NEW HI-TORQUE MOTOR holds speed under load. No need to go to bigger, heavier drills.

BALANCED DESIGN makes these power-packed tools easy to handle in any drilling job.



NEW REVERSIBLE FEATURE built-in at no extra cost for *full* power in either direction.

DRIVING A BIG AUGER is a fast job for powerful, new B&D Heavy-Duty Drills.



THOMPSON HELPS YOU LIFT LARGER LOADS FASTER!

Revolutionary . . . entirely new
CM Electric Hoist with housing designed for
greater strength and ruggedness
made possible by light metal castings.

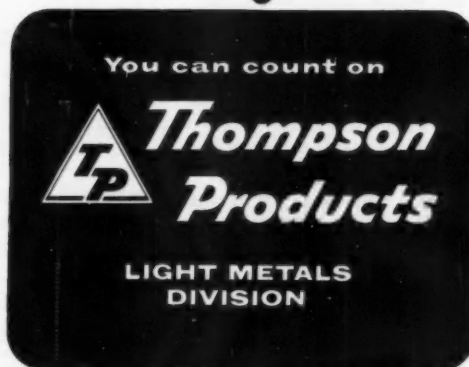


WHEN the Chisholm-Moore Hoist Division of the Columbus McKinnon Chain Corporation needed light weight castings for their all new CM Lodestar they turned to Thompson's creative Light Metals Division.

Working together, Chisholm-Moore and Thompson came up with well designed and engineered hoist castings that made possible a well manufactured hoist which, when completely assembled, weighs only 50 pounds! In addition, the entirely new, more efficient CM Lodestar Electric Hoist is manufactured with truly significant savings in production costs resulting in a better product at no increase in cost!

This cooperation is typical of Thompson Light Metals Division's close work with many diversified industries. Regardless of *your* product, if you use castings or impact extrusions, our engineers will be glad to show you how *you* can reduce costs with Thompson's Light Metal Castings.

We want to quote on your plans and specifications. Write, wire or phone Dept. AI-4, Light Metals Division, Thompson Products, Inc., 2269 Ashland Road, Cleveland 3, Ohio, HEnderson 1-6765.



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GROOVE PROTECTION IN PISTONS
FOR GASOLINE ENGINES

AN ECONOMICAL METHOD WITH
MINIMUM WEIGHT INCREASE

CAN BE APPLIED TO ANY TYPE
ALUMINUM ALLOY PISTON



PERMA-GROOVE*

WITH SEGMENTAL STEEL TOP RING SECTION

Again, Zollner engineering leadership provides another great piston development to engine builders. The new Zollner "Perma-Groove" gives sensationally longer life to pistons and rings, prevents blow-by, minimizes oil consumption. The light weight segmental steel section incorporates high wear resistance in the top ring groove *plus* the advantage of cool operation. Designed especially for gasoline engine pistons, "Perma-Groove" is the quality, low-weight and low-cost companion to the popular "Bond-O-Loc" piston for Diesel engines. We suggest an immediate test of "Perma-Groove" advantages for your gasoline engine.

*T. M. Reg. Pat. App. For



TOP RING SECTION



FRONT VIEW SECTION



CROSS SECTION

OUTSTANDING ADVANTAGES OF ZOLLNER "PERMA-GROOVE" TOP RING SECTION

1. Individual steel segments eliminate continuous band expansion problem.
2. Segments securely locked to prevent radial movement.
3. Dovetailed edges keep steel segments securely in plane with groove.
4. 75% steel bearing area for wear resistance.
5. 25% aluminum bearing area for heat conductivity and cool operation.
6. Light in weight.

ADVANCED
ENGINEERING
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WITH ENGINE
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PISTONS

THE ORIGINAL EQUIPMENT PISTONS

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SHULER'S NEW T18C AXLE

is **LIGHTER** Than Ever,
STRONGER Than Ever

Shuler axles, with their one-piece forged design, have led the "weight-strength" parade for years.

Now Shuler offers T18C series axles with *new forged steel hubs* and *new lightweight drums*. They give you the greatest possible weight saving with maximum strength. The new hubs weigh less than magnesium or aluminum hubs—over 70 pounds saving in weight at no extra cost over ordinary malleable iron hubs! And remember—Shuler axle centers are "one piece"—made of controlled analysis premium steel, forged and heat treated throughout to insure even toughness *all over*, to eliminate every possibility of failure due to uneven metal structure.

Want more facts? Write us for complete information. You'll discover why more and more automotive equipment manufacturers are specifying Shuler One-Piece Tubular Axles.

NEW MODELS INCLUDE:

- 1 New lightweight but permanent malleable brake shoes and removable spiders.
- 2 Roller Shafts are fitted into the shoes with precision-machining, to insure full bearing, and are then locked in place. *They can't fall out.*
- 3 Positive locking "roll pins" in the anchor pins.
- 4 Parkerized and hardened cam rollers for rust-proofing and long service.
- 5 Nylon inner and outer cam-shaft bushings.
- 6 Self-aligning "ball and socket" aluminum cam-shaft housing.
- 7 One piece forged and heat treated cams, precision ground and uniformly hardened at wearing surfaces.



NEW DRUM REDESIGNED FOR MORE STRENGTH, LESS WEIGHT

Notice those "buttresses" that encircle the perimeter of the new Shuler drum. They're the secret of its light weight and maximum strength. Unneeded, dead-weight metal has been eliminated—but *where strength is needed, the drum has actually been "beefed up"*. Engineering like this, and one piece forged axle design, make Shuler axle assemblies lighter than competitive makes. And Shuler maintains this lighter weight with top quality brakes, genuine malleable iron brake shoes, and greater area replaceable brake linings!

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